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Hudson Super-Six Again Leads the World

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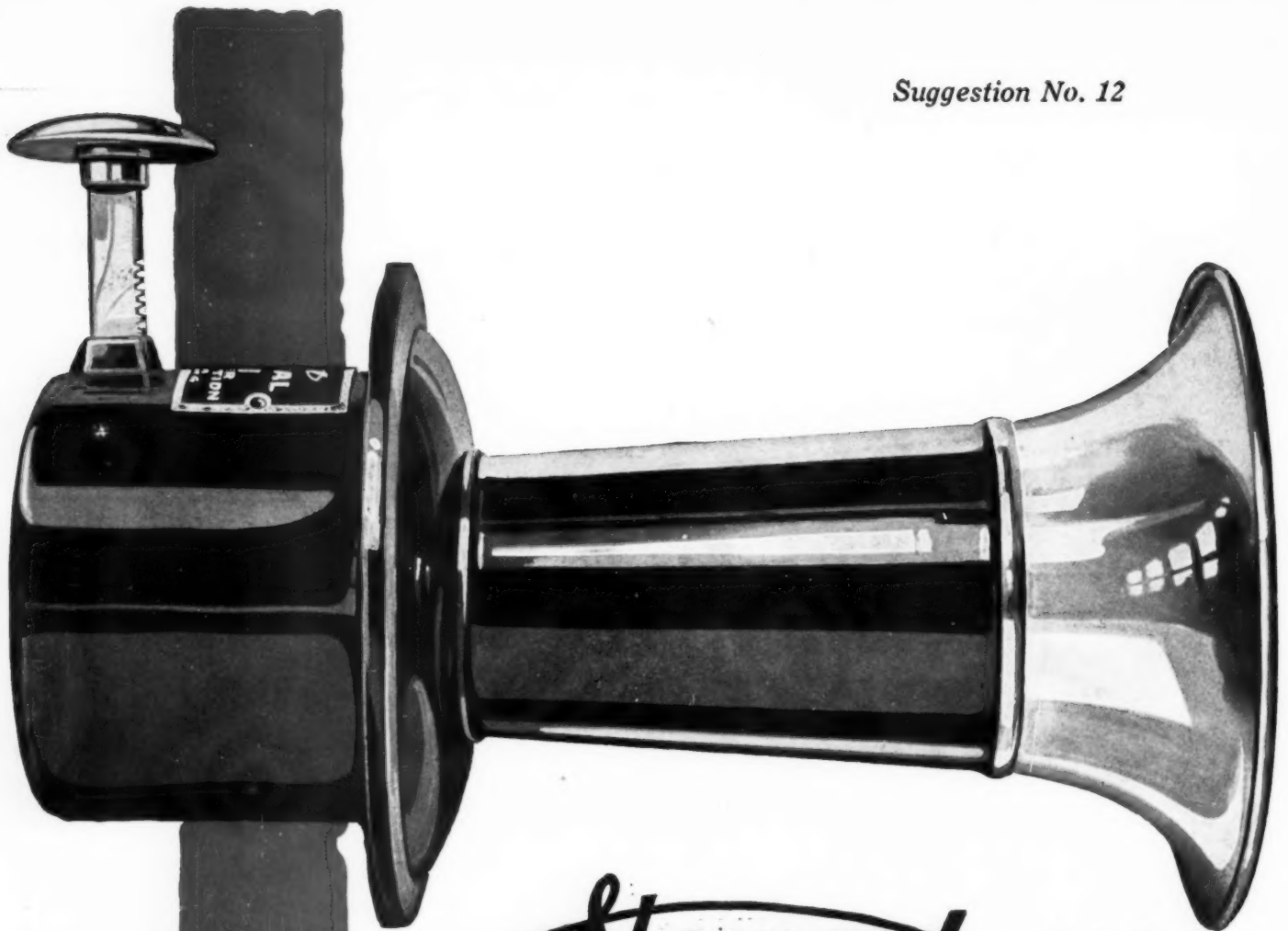
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The AUTOMOBILE

Are Other Cycles Possible?

Recent Suggestions Heard in Engineering Conferences Lead to the Belief That Cycles Other Than the Otto May Prove Useful—Constant Pressure Type a Possible Answer

By J. Edward Schipper

ONE of the effects of the fuel controversy which has spread from one end of the world to the other, has been to cause engineers to wonder if there be not some other way of utilizing the heat energy in liquid fuel. The present method employed in automobiles makes use of the basic scheme known as the Otto cycle. This method of transforming the latent heat energy in the fuel into dynamic mechanical energy, was first suggested by Beau de Rochas in 1870, and actually employed in an engine designed by Otto in 1876.

With wide open throttle and with excellent carburetion, and nearly complete combustion, the thermal efficiency of the up-to-date automobile engine is from 18 to 20 per cent. When the car is running at a touring speed of 15 to 18 m.p.h. and the throttle is possibly less than one-third open, the thermal efficiency is somewhere around 5 per cent. In other words, for every dollar's worth of fuel 5 cents in power is returned. The maximum possible efficiency of the Otto cycle is somewhere around 35 per cent, and it is these conditions, coupled with the increased price of fuel, which has caused some engineers to wonder if some other type of cycle, which had been developed mechanically to the same extent as the Otto cycle, could not be used to better advantage.

Thermo-Dynamic Classification

Thermo-dynamically engines are classified according to the way in which the heat is introduced. Engines may operate on a constant temperature cycle, a constant volume cycle or a constant pressure cycle. Each of these is distinctive in the manner in which the fuel is handled, and each has a certain efficiency which could be reached by a theoretically perfect engine, but which is beyond attainment by a mechanical creation designed to work upon that cycle.

Engines operating on the constant-temperature cycle take the heat in at a temperature which remains constant throughout the period of supply. Expansion then follows

the cut off and the heat is also rejected at a constant temperature.

Constant volume engines take in and reject the heat at a constant volume and constant pressure engines take in and reject the heat at a constant pressure.

The Otto cycle is theoretically a constant-volume cycle and the point which it is desired to determine is whether or not it would be possible to mechanically develop engines working under the constant temperature or constant pressure cycles which would give as great or more satisfaction.

The effect of compression on the Otto cycle is very important, and there is little doubt but what manufacturers would work to a much higher pressure than they do now, if it were not for the fear of pre-ignition. The difference in efficiency between motors of 75 lb. compression and those of 100 lb. which are the same in other details of design is marked. The instability of the compressed mixture is the greatest difficulty to overcome.

Constant Temperature Cycle

The constant temperature cycle may be considered first and its maximum theoretical efficiency noted. Referring to the constant temperature cycle diagram, Fig. 1, the line *OV* represents the reference line of volumes, *OP* the reference line of pressures, and *abcd* the line which diagrammatically represents the pressure and volume conditions in the cylinder at any point.

On this cycle the line *bc* represents compression, heat is taken in from *c* to *d* at constant temperature and expansion takes place from *d* to *a*. From *a* to *b* heat is rejected at constant temperature. The efficiency of this cycle is equal to the amount of heat taken in by the gas less that rejected at the lowest temperature, divided by the heat taken in.

Steam engines working on this cycle with a steam pressure of about 150 lb. to the square inch and exhausting into a condenser having 28 in. vacuum, or in other words, working between absolute Fahrenheit temperatures of 819 and

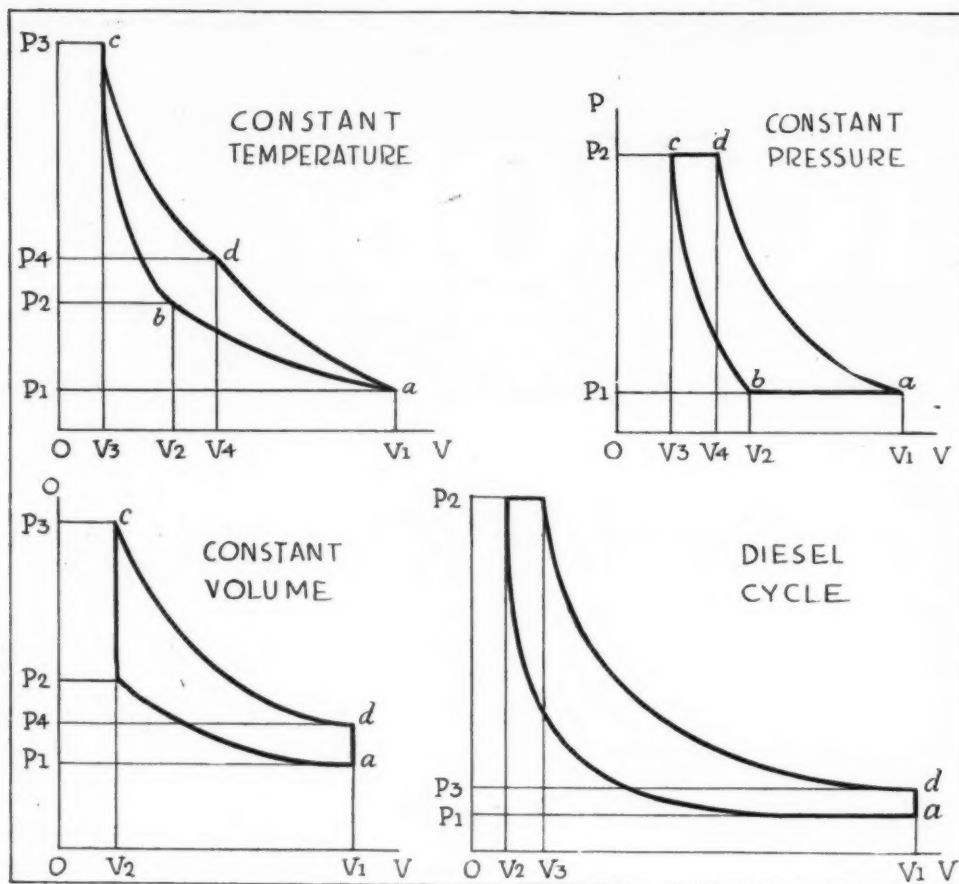


Fig. 1—Indicator diagrams of the constant temperature, constant pressure and constant volume cycles and the Diesel cycle

563 deg. would have a theoretical efficiency of 31.3 per cent. Practically an engine under these circumstances would reach about 15 per cent. In a gas engine when ignition occurred at *c*, the piston travel would have to be very rapid in order to hold the temperature constant down to the point *d* where expansion begins, or else the gas would have to be burned as it was introduced. This would allow of expansion during combustion and after cut off.

Suggests Slow Combustion

This process of working immediately suggests slow combustion, as compared to explosion, and that in turn suggests lower grade fuel; but this situation suggests heavy, slow-moving parts which are in every way opposed to the present requirements of a high-speed internal combustion engine.

cd is exactly horizontal which shows that during the time of burning the piston has moved in such a way that the volume has increased sufficiently to hold the pressure constant. Both lines *cd* in the constant volume diagram and *da* in the constant pressure are adiabatic expansions.

Similar conditions hold true at exhaust where the exhaust line in the constant volume diagram is vertical and in the constant pressure is horizontal on the theoretical cards.

It is this constant pressure cycle which some engineers are studying with a view to determining whether or not the conditions which hold true with the lower grades of fuel render its use commercially advantageous. With the more volatile fuels and the greater possibilities of exploding or burning the charge at constant volume, the constant volume cycle has been favored, but with fuels that are slower burning but

When worked out practically, the area inclosed in the thin crescent-shaped diagram would no doubt be very small, giving a low work value. Another loss as compared to the theoretical card would be that the point *a* on the practical diagram would not be on the atmospheric line but above it. This would still further reduce the area inclosed by the diagram, or, in other words, reduce the amount of work per charge. With these points in view and with the general clashing of the possibilities of this cycle with the requirements of up-to-date practice it can be discarded and thoughts turned toward the other cycle, the constant pressure, the possible alternative.

Studying the diagram of the constant pressure cycle, Fig. 1, and comparing it with the constant volume diagram, Fig. 1, it will be seen that the line *bc* in the constant volume diagram is vertical, showing that during the entire explosion stroke on the theoretical engine the piston has not moved, or in other words, instantaneous combustion has taken place. This condition, of course, is not reached in practice and the line *bc* is never vertical even at very high speeds with wide open throttle. On the constant pressure diagram the line

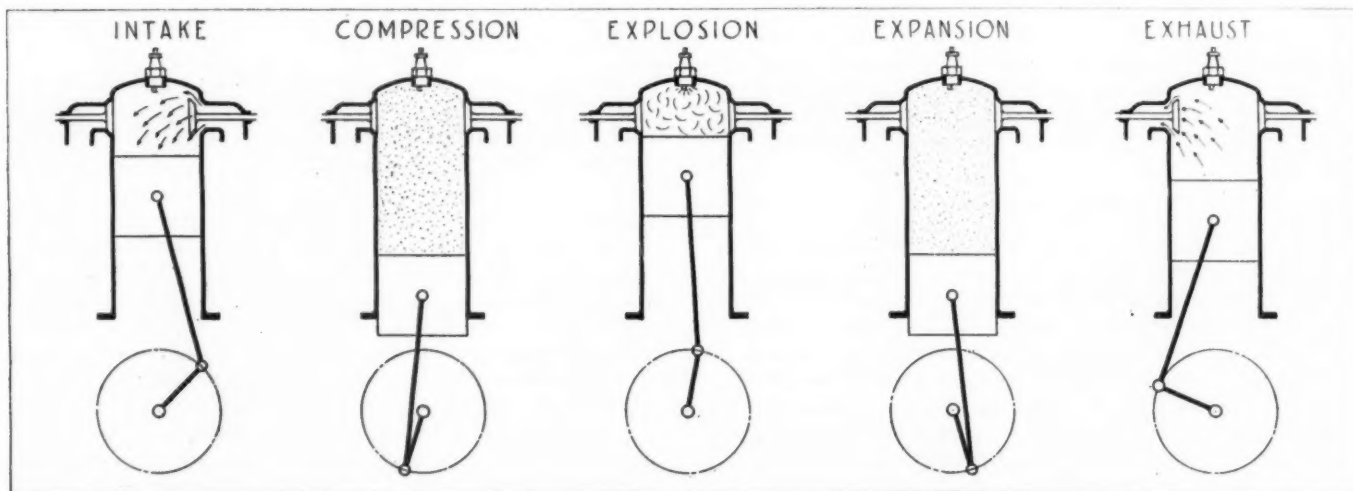


Fig. 2—The ordinary Otto cycle has five operations, intake, compression, explosion, expansion and exhaust

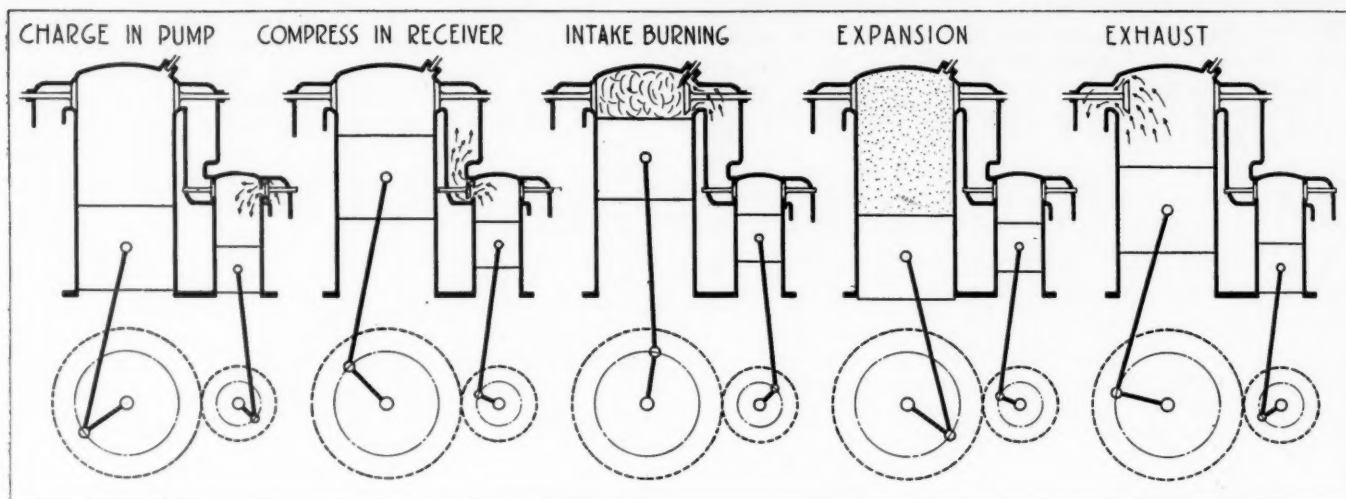


Fig. 3—Ignition at constant pressure with previous compression: charging pump at atmospheric pressure, compressing into receiver, admitting burning charge, expansion and exhaust

which at the same time contain a greater amount of heat energy for the same volume, it may be quite possible that the constant pressure cycle can be adapted to use.

Constant Volume Engine Efficient

While under similar conditions and with the same explosive fuel the constant volume engine is more efficient than the constant pressure, it seems possible that by carrying out the expansion line of a constant pressure type a higher efficiency may be reached, particularly at reduced throttle opening. The Diesel engine, for example, works on a cycle which as far as heat intake is concerned is a constant pressure type, but which at exhaust is more like the constant volume engine. The diagram of the Diesel cycle is shown in Fig. 1.

The high efficiency of the Diesel engine in large units has naturally attracted many to the view that it should be possible to make this power plant in small enough units to use in automobiles, and several attempts have been made to do this. While it does not seem possible just at this time to make the Diesel engine a commercial possibility as far as automobile work is concerned, the idea of coming quite close to this by using the constant pressure cycle is one which is provoking a great amount of thought at this time when fuel is far more plentiful in the heavier than in the more volatile grades.

The first thought suggested by the constant pressure engine is high compression. The idea that this necessarily means an efficiency loss, is often held by those who have not realized that practically all of the energy necessary for compression is returned in the expansion stroke. Ignition begins at upper dead center on the firing stroke and burning takes place along the horizontal pressure line until the predetermined cut-off point is reached. This means that fuel must be constantly introduced against the maximum cylinder pressure and this in turn means a receiver capable of withstanding the high pressures. It also means the employment of a compression pump with its consequent efficiency losses and a satisfactory ignition scheme; but the question to be determined is whether or not other gains do not offset this.

Engines working under the constant volume principle cannot carry compression beyond the pre-ignition point of the fuel, but in the Diesel engine pure air alone is drawn into the cylinder and the fuel is not admitted until after compression, so that very much higher compressions may be used with it. This same possibility holds true with the constant pressure engines, and in fact it seems that in order to secure the maximum amount of efficiency this compression ratio must be high.

In actual working, Dr. Rudolf Diesel points out, the compression ratio with his engines is about twelve as against six or seven with other gas engines. Working out the efficiencies in the two cases with the ratio six in one case and twelve in another, he shows that they are 0.51 for the six ratio and 0.63 for the twelve ratio.

It must be granted then, that in order to secure the desired efficiency from the constant pressure engine it is necessary to work at high compression and the point for practical engineers to determine is whether or not it is possible to secure the high compression ratios in satisfactory and reliable units of the size which would allow them to be used on automobiles.

Lost Work Area

There is no doubt but that at the present time we are sacrificing work at the end of the stroke by cutting off the expansion line and exhausting at high pressure. In the ordinary timing diagram the exhaust valve starts to open at fully 45 deg. before lower dead center so that the pressure will

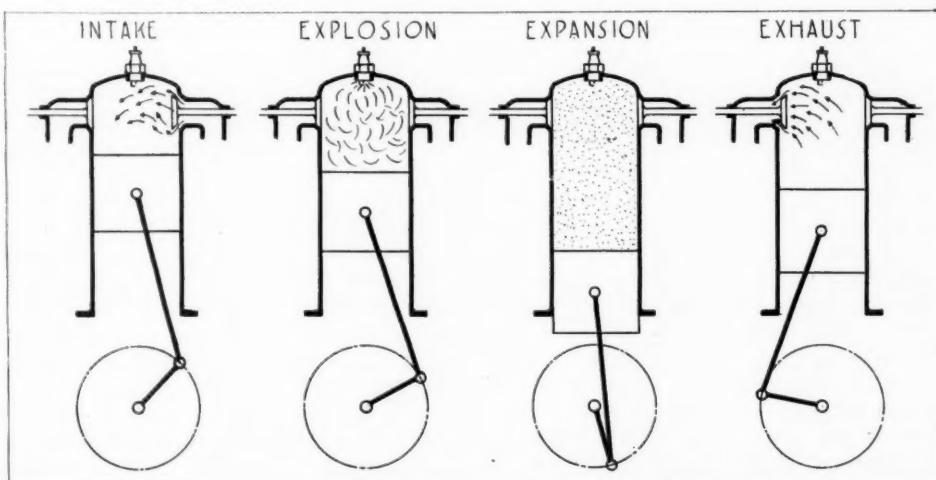


Fig. 4—Charging cylinder at atmospheric pressure, exploding the charge, expansion and exhaust

have dropped to near atmospheric by the end of the stroke. With very high speed motors the time at which the exhaust valve starts to open is much further advanced than this, and the difference of a degree or two on the timing circle is quite large when the angle between the crank and 90 deg. position is less than 45 deg.

To carry the working diagram all the way out until it is quite close to atmospheric pressure generally means a lower speed engine than what would be considered satisfactory in the light of present-day practice.

Mechanical Cycles Classified

It is of hardly any use to go over the old adaptations of these three types of cycles in the early gas engines. It is interesting to note, however, how these early designers who had nothing but the theoretical consideration to work from sought to apply the principles to practical engines. The constant temperature cycle for internal combustion purposes was neglected and the engines which really were built and put into operation can be classified as follows:

- 1—Those with ignition at constant volume without compression.
- 2—Ignition at constant pressure with compression.
- 3—Constant volume engines with compression.

The operations which each of these engines perform are shown diagrammatically in Figs. 1, 2 and 3. The engines under class 1 are of course commercially impossible and of low efficiency. The cylinder is charged as shown in Fig. 4, with explosive mixture at atmospheric pressure. The charge is exploded, expanded and exhausted.

Second Type

The second type with ignition at constant pressure with previous compression is the type of engine just discussed and the one in which it is supposed by some there lies some hope of higher efficiency with lower grade fuels. Engineers who have made history in the gas engine field have worked on this cycle. Among them may be mentioned Brayton, who had an engine in 1872; Foulis in 1878; Crow in 1883; Clerk in 1889 and Diesel in 1892.

Although the engines operating on this cycle perform five operations this was generally accomplished by the engineers named in two strokes. The pioneers in the two-stroke field were Clerk, Robson and Atkinson, in Great Britain and Koerting on the continent. Very ingenious mechanical cycles were invented by these early workers and the engines performed in a manner sufficiently satisfactory to guarantee the future of the gas engine.

The five operations performed by the second class of engines igniting at constant pressure with previous compression are: First, charging a pump cylinder with gas and air mixture at atmospheric pressure. Second, compressing the charge into an intermediate receiver. Third, admitting the charge into the cylinder from the receiver against the compression pressure in a burning state. Fourth, expansion. Fifth, exhaust.

Third Type

The third type of engine is the constant volume design with previous compression which is represented by the Otto cycle and which is in use in all our cars to-day. Although this cycle is generally performed mechanically in four strokes there are in all five operations: First, intake in which the cylinder is charged with gas and air at atmospheric pressure; second, compression; third, explosion; fourth, expansion; fifth, exhaust.

Thus in the two cycles which it is desired to compare each has five separate and distinct operations. We are so accustomed to the seeming ease of accommodation of this third type of engine to the requirements of the automobile that it may be that the possibilities of the second type or the con-

stant pressure engine have been somewhat overlooked. If difficulty is to be encountered, however, in the latter, it will no doubt be in the accommodation of small but efficient high-pressure units to take care of the necessity of injecting the fuel into the cylinder against compression pressure.

Something has been said recently about altering the point of cut-off of the constant volume engine as a means of holding up the thermal efficiency even when operating on partial throttle opening. This in practice would be accomplished by variable cam action and has in fact been tried. It has not worked out satisfactorily, however, on account of mechanical complications. The possibilities of variable cut-off in constant pressure engines are very much greater. On this cycle it is possible to definitely determine the amount of burning fuel admitted to the cylinder in the same way that it is possible on the steam engine to determine the amount of steam admitted. In fact the indicator card has a similarity in many respects to what would occur in a constant pressure gas engine with variable cut-off.

Variable Cut-off Possible

Whether or not the variable cut-off constant-pressure gas engine can ever be adapted to the quick-accelerating, lightweight automobile is a question that is now so hazy that it is impossible to make any predictions with clearness. Yet there can be no doubt that since this subject is one which is ripe for investigation at the present time much light can be thrown upon it and possibly some interesting developments occur. Even with kerosene engines running on the Otto cycle or at least a modification of it, there have been vaporizing instruments suggested which admit the fuel to the cylinder in a state of flame. This is not by any means an impossible state of affairs, but rather one which lends itself readily to the idea of carrying out the expansion line to the greatest possible extent in order to secure the maximum work area on the indicator card from a given amount of charge.

It seems very well possible that the answer to the whole problem lies not in compressing the combustible mixture but rather in compressing the air only and adding the fuel by small successive charges during the stroke. This gives a series of small explosions giving the high-compression efficiency and at the same time holding down the violence of explosion by substituting burning in a highly-compressed atmosphere. A fine line between burning and explosion cannot be drawn, but where successive small quantities of fuel are injected into the compressed air the result is a series of small impulses instead of one violent blow.

This burning charge idea brings back to mind the arguments used by many of those who favored steam in the earlier days of engine manufacture. The burning fuel closely parallels in many of its characteristics super-heated steam. If it can be introduced into the cylinder, cut off, expanded and exhausted in much the same way as steam, it would have in many respects the advantages of the steam engine without the boiler apparatus necessary for the conversion of water into steam. In other words, the proposition is quite plainly a question of whether or not the Diesel or some modification of its cycle cannot be utilized in automobiles.

In many ways the constant pressure cycle seems to be more elastic than the constant volume. Once you have a given cylinder size to fill and a definite compression, which must always be worked to regardless of throttle opening, the engine is bound to fall off in thermal efficiency to a great degree on lesser throttle openings. On the other hand in an engine where the length of the stroke does not necessarily fix the amount of mixture drawn in, and where the volumetric efficiency of the engine does not cut such a heavy figure, it seems quite possible that engines may be constructed which, although no more efficient on full throttle opening, will at least exceed the 3 or 4 per cent secured with the throttle opening used at touring speeds.

Imperfections of Lubrication

How Oil Is Contaminated in an Automobile Engine by Water, Gasoline and Dust—Precautions That Should Be Taken To Prevent Ill Effects

By C. W. Stratford

CONTAMINATION of lubricating oil in the crankcases of automobile motors is without question one of the most potent causes of defective lubrication, and of the numberless attendant evils that follow in its wake. However good the quality of lubricating oil may be originally, when seriously contaminated in the motor sump by water, gasoline, carbonaceous and metallic sediment, or sand, it soon becomes unsatisfactory as a lubricant and its continued use will prove to be very costly in the end.

Water Forms in Oil

Many motorists are astonished to find a considerable quantity of water in the oil drained from the crankcases of their motors. This water has its origin principally in the products of combustion. The burning of a mixture of gasoline with air results in the formation of water vapor and other gases, which are of minor interest here. These gaseous products escape past pistons and rings during the expansion stroke into the crankcase, where the superheated steam condenses into water and sinks to the bottom of the oil sump. Some leakage inevitably occurs, even past the most carefully fitted pistons and piston rings.

The percentage of water formed by combustion is variable and depends to a considerable degree upon the adjustment of the carbureter; that is, whether the mixture is oxygen-rich or oxygen-poor. On burning, rich mixtures (oxygen-poor) give the largest percentage of water and result in the deposit of free carbon. Lean mixtures (oxygen-rich) give the smallest amount of water on burning, and leave behind no carbon deposit. With the average carbureter adjustment the quantity of water present in the products of combustion is approximately 10 per cent. Therefore it is evident that if these products are allowed to leak into the crankcase, past defective piston rings, a relatively large amount of water will be condensed there. During hot weather most of the water vapor passes out through the breather orifices before condensation can take place. This accounts for less trouble being experienced in summer than in winter.

Temperature Is Influence

The operating temperature of the motor has also a marked influence upon the rate of water formation in the crankcase. The lower the operating temperature, and the greater the leakage past pistons, the greater will be the quantity of water formed and vice versa.

All small-bore multiple-cylinder motors experience this difficulty to a greater extent than do larger motors which operate at higher temperatures. Another feature peculiar to multiple-cylinder motors, compared to four- and six-cylinder motors of like capacity, is that of a greater total piston ring length exposed to leakage.

This means that in the multiple-cylinder motor there is an increased likelihood for leakage, due alone to the increased lengths of the piston ring surfaces.

If the lubricating oil is of good quality and free from

"sulpho" compounds and animal or vegetable oils which cause emulsification, the admixture of water in the crankcase will have no injurious effect whatever upon the oil.

If, on the other hand, the oil emulsifies readily with water the gelatinous product formed may clog the entire lubricating system and lead eventually to burned-out bearings or other serious damage to the motor. The admission, however, even of good oil mixed with water into the circulating pump is sure to decrease materially the efficiency of lubrication, if not to cause more serious damage especially when the motor is running at full load and high speed.

When water is present in the sump of a motor, and the inlet side of the oil circulating pump is exposed to it, the water is likely to freeze during very cold weather, and, when the motor is started, the pump itself may be damaged or broken. During the past winter this trouble has been widely prevalent, but the cause for such breakage has not always been clearly recognized by users and service men.

Gasoline in Oil

Accumulation of gasoline in the motor crankcase arises from leakage of the gasoline-air mixture past pistons and rings during the compression stroke. In cold weather, if low grade fuels are used, part of the atomized gasoline is not completely vaporized by the heat of compression but falls upon the piston head and is blown past the piston and rings into the crankcase by the pressure of the compression and explosion.

Leakage Always Occurs

Some mixture leakage occurs with all fuels. In this way gasoline, accumulated by leakage either in liquid form or by condensation after leakage, in the motor sump, thins down the oil. As in the case of water condensation, less trouble is had with crankcase gasoline in summer than in winter and for the same reason. As an indication of the thinning effect which gasoline has upon lubricating oil, 5 and 10 per cent mixtures were made with a fresh sample of oil of known viscosity.

OIL GASOLINE BLENDS

| Viscosity (Saybolt) | Fresh Oil | Fresh Oil Plus | |
|---------------------|-----------|---------------------|----------------------|
| | | 5 Per Cent Gasoline | 10 Per Cent Gasoline |
| 100 deg. Fahr..... | 241 | 163 | 111 |
| 212 deg. Fahr..... | 45 | 42 | 40 |

The results show that the body of the oil at average crankcase temperatures, 100 deg. Fahr., with 5 per cent gasoline mixture is thinned down 32 per cent and with the 10 per cent blend, at the same temperature, 54 per cent. At 212 deg. the viscosity of the oil is reduced 7 and 12 per cent, respectively with the 5 and 10 per cent mixtures. This goes to show that the higher the temperature, the less is the thinning effect of gasoline.

Viewing these results from a practical angle, the effect of using oil in which there is a considerable percentage of gaso-

line would be to increase greatly the direct leakage of oil from the crankcase to the outside, as well as to cause a more rapid leakage of oil past the pistons into the explosion chamber, thus augmenting carbon deposits. Insofar as lubrication goes, very little difference in motor efficiency or immediate wear would be noticed. In general terms, this means that when a motor is started with fresh oil of medium body, gasoline contamination up to 10 per cent would result in thinning down the oil to a viscosity about equivalent to that of a light oil at cylinder wall temperatures.

Over a season's running, however, an appreciable increase in wear would doubtless be noticed. In addition, the weakening of the oil seal between pistons and cylinder facilitates the escape of gases from the combustion chamber.

Carbon and Carbonaceous Matter

When any hydro-carbon oil is exposed to high temperatures, as in the crankcase of an automobile motor, it suffers gradual decomposition. The rate of decomposition depends chiefly upon the temperature of the parts with which the oil comes into intimate contact, and upon the chemical purity and stability of the oil. The products of this decomposition consist of lighter hydro-carbons, free carbon, and complex, solid, polymerized compounds, called carbonaceous matter. The character of crankcase sediment varies widely and is greatly influenced by the thickness of the piston heads and the fit of pistons and rings in the cylinders, also upon the load carried by the motor. An analysis of sediment, taken from the crankcase of a touring car motor, after a month's running, shows free carbon under 2 per cent, metal dust under 1 per cent, road dust $1\frac{1}{2}$ per cent, carbonaceous matter approximately 96 per cent.

Value of Aluminum Piston

The superior conductivity of aluminum pistons reduces the temperature of the piston heads to such a degree as to practically eliminate the formation of a carbon cake on the underside of the piston heads. The use of aluminum pistons is accompanied by a decrease in the rate of decomposition of the oil in the crankcase, due to their lower temperatures. The operating temperature of most cast-iron or steel pistons is sufficiently high to cause the formation of a carbon deposit on the bottom of the piston head. As this carbon deposit becomes thicker and thicker, the temperature of the piston head, due to the poor conductivity of the carbon cake, builds up to a point where premature ignition occurs. Particles of the carbon cake formed under the piston heads are washed off by the oil splash, and fall back into the crankcase and there mix with the oil in circulation. The application of screens between the main crankcase and the oil sump prevents the greater part of this deposit from mixing with the oil. A goodly quantity of it is sufficiently fine, nevertheless, to pass through the screens and in that way to enter the lubricating system.

Neither carbon nor carbonaceous matter, present in the crankcase sediment or as constituents of the carbon residue on the explosion chamber walls, are hard enough to cut the bearing surfaces in moving contact. But they possess, no lubricating properties.

They partially take up the place of useful oil in the bearings and consequently decrease the efficiency of lubrication in proportion to the quantity present.

Use of Filters

The application of filters to the lubricating system of an automobile motor would effect the separation of the sediment in the oil, but such filters rapidly clog unless given attention and cleaning. In the hands of inexperienced operators, any filters interposed in the lubricating system of a motor might lead to under-lubrication and injury of the motor parts.

Metallic Sediment

Metal dust results from the abrasion of parts which come into moving contact. No machine was ever built in which there is no wear, consequently in automobile motors an amount will occur directly proportional to the efficiency of lubrication, and metal sediment will always be present in the used oil. It is obvious that the presence of hard metallic particles in the lubricating oil will appreciably increase the rate of wear.

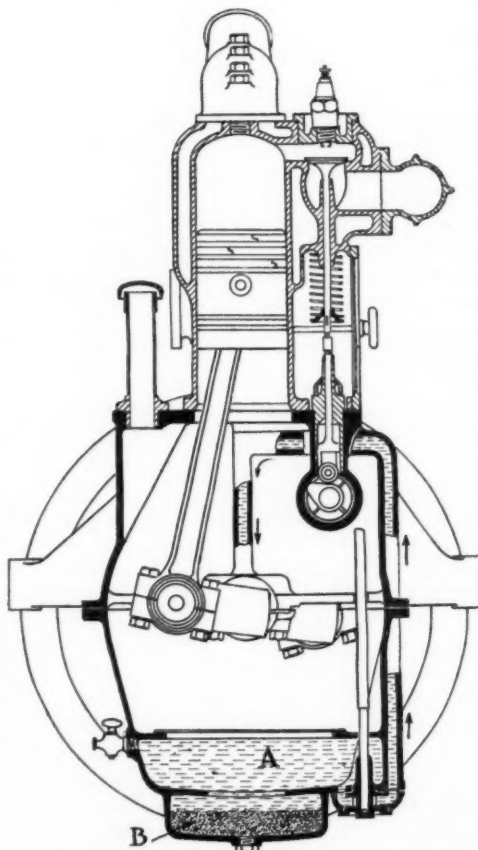
In new motors, formation of metallic sediment proceeds rapidly during the process of "running in." To obviate possible injury, the crankcase of new motors should be drained and thoroughly rinsed out with kerosene at the end of the first hundred miles of running. Part of the small percentage of metal sediment which accumulates in the oil, is sufficiently fine to remain in permanent suspension so long as the oil is in motion, unless provision is made for its separation.

Road Dust and Sand in Air

As we all know, for the operation of internal combustion motors, a continuous stream of air passes through the carburetor into the cylinders. Were this air dustless at all times, no sand or road dust would be found in the carbon deposit above the piston or in the oil within the crankcase. Such a condition of air purity is exceptional. The quantity of dust in the air is affected by many things such as wind, weather, character of roadbed, etc. When a motor car is driven over the average road, especially in dry weather, or in the wake of other vehicles, the air which is drawn through the carburetor is highly charged with finely divided sand or earth particles. This sand is carried in the charge at high velocity into the cylinders where it collects in the oil covering the cylinder surfaces and contributes to the friction load of the motor.

It is possible that part of this dust works its way from the cylinder walls into the crankcase. The pulsation of the air within the crankcase may also cause the entrance of dust by way of the breather pipe. The danger of scored cylinders and bearings is much greater with sand than with metal dust.

From the foregoing it is apparent that some positive means of separating all sediment, which becomes mixed with the lubricating oil in circulation, would be highly desirable from the viewpoint of both manufacturers and users. In very few modern automobile motors has sufficient provision been made for natural sedimentation. The location of most circulating pumps is



A shows clean oil and B dirty sediment. Observe that the intake to the oil pump is in the clean oil and well above the sediment.

such as to offer comparatively easy entrance of the sediment into the pumps and thence to the bearings. It would be difficult to assign any definite figure to the rate of wear and resultant maintenance cost.

Research work on motors in the laboratory, and a few careful tests of automobile motors on the road, have proved beyond doubt that a separation of all injurious sediment from the lubricating oil in circulation more than trebles the possible mileage between complete motor overhauls.

As a suggestion, looking toward higher efficiency of lubrication, a sediment basin of approximately one-fifth of the total volume of the oil sump is to be recommended. The crankcase illustrated is thoroughly practical and shows the correct position of the inlet to the circulating oil pump, sediment basin, baffle ledges to prevent mixing sediment with the oil in circulation, and the plug for draining the sediment basin.

The advantages accruing from this design are multiple, making possible the automatic separation of all deleterious matter and water from the lubricating oil. The frequency of draining the sediment basin will depend upon the rate of leakage of all contaminating substances into the crankcase, operating temperatures, service conditions of the motor and essentially upon the quality and suitability of the oil used. A complete draining of the sediment basin once every thousand miles should be sufficient with the majority of motors.

Since wear and maintenance cost depend directly upon the efficiency of lubrication, the application, in the manner shown, of sediment basins on every motor manufactured, should substantially repay the manufacturer by immediately decreasing the length of his complaint lists, and extending the popularity of his car. The benefit to the car owners would be less motor trouble, fewer repair bills, unfailing and efficient lubrication—satisfactory service.

Getting Proper Brake Action with Hotchkiss Drive

Special Precautions Necessary to Prevent Automatic Application of Brakes by Road Shocks

By A. Ludlow Clayden

IT is a well-known fact that the movement of a rear axle with respect to the frame of a chassis is irregular. With a firmly anchored torque tube the axle center swings as on a pivot and must have its vertical displacement along the arc of a circle, but when the drive is taken through the springs the flattening or curving of the spring causes the axle to move fore and aft as well as up and down, this having to be allowed for on the driveshaft by the provision of at least one universal with a sliding member or telescopic joint.

With the usual cambered spring, compression on passing over a bump in the road causes the axle to move back relative to the frame, and the rebound after the bump will pull the axle forward beyond its normal position. For the majority of bumps the total deflection of the spring is small, which means that the fore and aft movement of the axle is insignificant;

but there are cases where this general law does not hold true, and the most important is that of motor trucks.

On a passenger car the load does not vary much, but on a truck the load may account for inches of compression on the spring. Suppose the camber of a truck spring is 8 in. deep when the truck is empty, this may be reduced to 3 in. when the full load is on. This means that the axle moves backward as the truck is loaded and forward as it is unloaded, passing over bumps causing the usual fore and aft movement but with a different mean position for the axle according to the load.

Brakes Applied Automatically

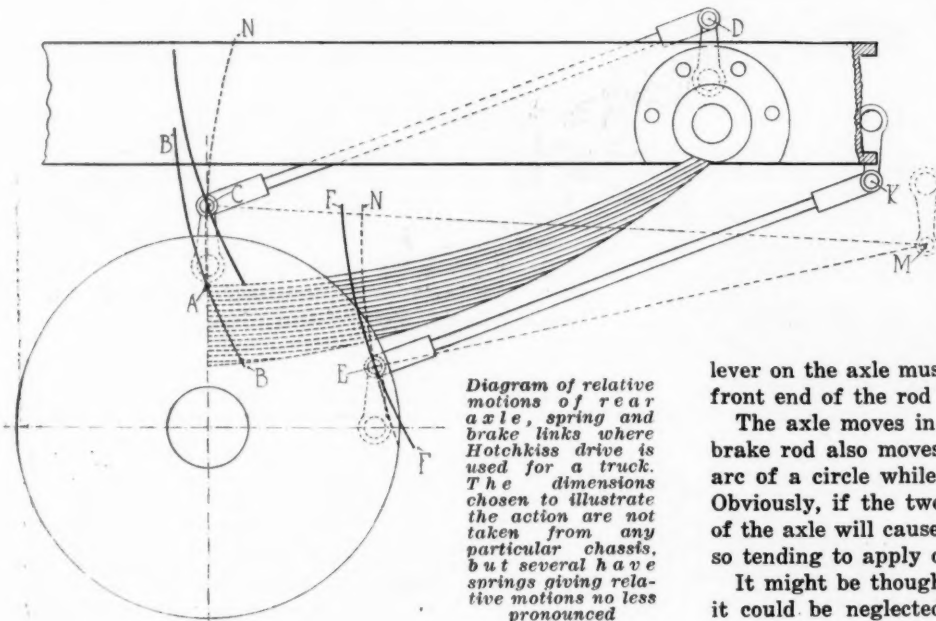
On a truck, the total amount of movement fore and aft may be quite considerable when the variation due to load is taken into consideration, together with that due to road shocks. Therefore, allowance must be made somewhere to prevent automatic application of the brake caused by the movement of the axle.

Consider the case geometrically. The brake actuating lever on the axle moves in a curved path; to it is attached the brake pull rod, and the front end of the pull rod is attached to a lever somewhere on the chassis frame. The rod is of fixed length and so the end which is pinned to the brake

lever on the axle must swing in an arc of a circle having the front end of the rod for its center.

The axle moves in a curved path and the rear end of the brake rod also moves in a curved path, but the latter is an arc of a circle while the former need not be and seldom is. Obviously, if the two paths do not coincide, then movement of the axle will cause the brake lever on the axle to oscillate, so tending to apply or to release the brake.

It might be thought that this tendency was so slight that it could be neglected, but laying out the curves on paper



shows that this is not true. Often it is not sufficient to place the brake countershaft at any convenient position and to link it up to the axle while trusting to lost motion in the brake band itself to care for the oscillation. That this is so is shown in the cut below. Admittedly, the case chosen for illustration is an extreme one, but there are plenty of such cases to be found in trucks. The proportions of the spring are not so very abnormal.

Referring to the illustration, the path of the middle point of the spring as under compression and expansion is plotted, *A* being the normal point and *BB* the curve. Also the paths of two brake lever eyes, one at the top of the brake and the other on the horizontal line. Regarding these two curves, it is obvious that there is for each of them a circle, an arc of which will approximate closely to their curvature. Choosing two such arcs, one for each position of the brake lever, we then see that there are only two possible centers for the front end of the brake rod; in other words that the length of the pull rod and the position of the front end of the pull rod are fixed absolutely when the position of the brake lever on the axle has been decided.

Variations Are Large

Taking the top position for the lever on the axle, the arc which corresponds most nearly to the path of the eye has a radius *C, D*, which gives a pull rod of normal length. If this rod swings on a high placed center *D* it will be possible to have all variations of load and road shock without dis-

turbing the brake setting, but if the center is low placed, as at *M* then the travel to and fro of the end of the brake operating lever can easily be as much as 3 in.

Taking the horizontal position for the lever, the nearest arc has a radius *E K*, permitting the use of a brake rod placed in a more convenient position, but here observe the evil effect of using too long a pull rod by contrasting the arc *F* obtained from center *K* with the arc *N* obtained from center *M*.

It may often be found on passenger car chassis, especially those with flat springs, that there is considerable latitude for the pull rod center. On trucks, however, there can seldom be much latitude, for maximum brake effectiveness.

In brake design there is one very definite limitation, and this is the amount of movement that can be given to the brake pedal. The operating range for the driver's foot is not very large, so that lost motion anywhere in the linkage is equivalent to a reduction in the useful travel of the pedal. This means that, if allowance has to be made for much lost motion, adjustment of the brake will need to be made far more frequently. Suppose the pedal has a travel of 6 in. and there is no lost motion, it will be possible to adjust the brake to come into operation fully after the pedal has been depressed 2 in., leaving 4 in. to take care of wear, 4 in. to be used up before adjustment is necessary. If a big allowance for lost motion is required this 4 in. may easily be reduced to 2 or less, so cutting in half, or less than half, the period before adjustment will be called for.

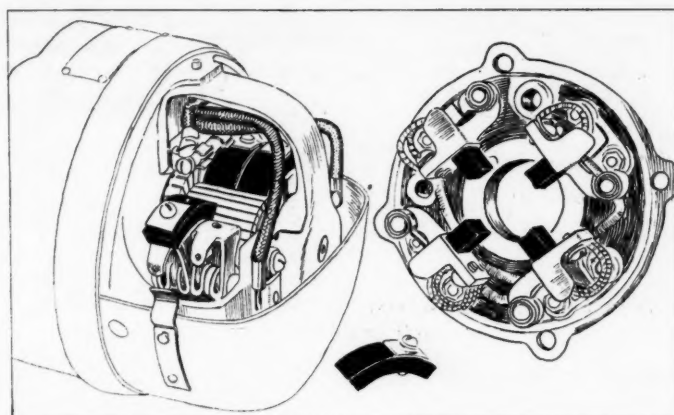
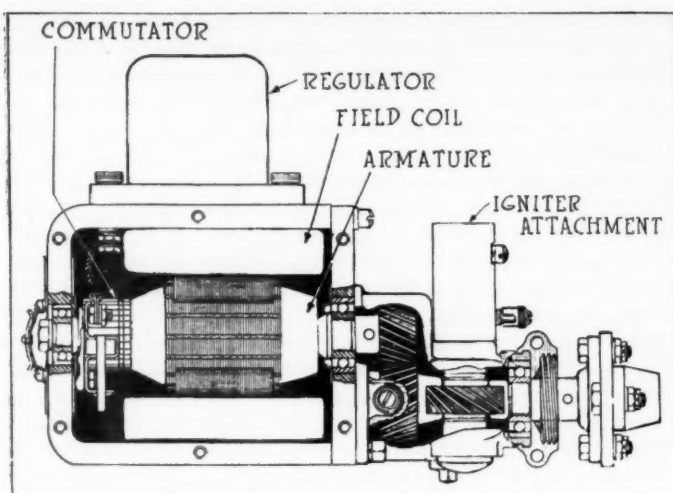
Fifteen Studebaker Ambulances for Russia—One for France



FIFTEEN Studebaker Sizes, all 1916 models, equipped for service as ambulances in the Russian Army, are to be sent to Russia, April 20, by the American Ambulance in Russia, which within two months raised funds enough for the complete purchase of this flotilla and its equipment.

On April 10 the ambulances were formally turned over to Consul General Oustinoff after they received the blessing of Archbishop Evdokim of the Greek Orthodox Church of North America.

The ambulances will be in charge of Dr. Phillip Newton, who holds a general's commission in the Russian army, bestowed upon him by the Czar for his services with the Russian army under fire. Dr. Newton came to this country about two months ago to raise funds for this flotilla, which will include two repair cars, one pilot car, a hospital car with tent, and twelve ambulances, one of which goes to France. These ambulances will be equipped with four stretchers, and there will be sitting room for eight wounded.



Right—North East unit, showing commutator. Autolite brush assembly. Left—Gray & Davis generator, showing regulator, armature, etc.

Automobile Electricity

Locating and Curing Troubles

PART III

Troubles by Units Considering Each Individual Part of the System Separately and Denoting the Troubles Which Are Commonly Found in Those Parts

By J. Edward Schipper

Synopsis

Part I—April 6

¶ Three fundamental thoughts were established in the first part of this electrical series.

¶ First: Continuity of which the circle is the symbol. Electricity flows in a circle or circuit. The circle must be complete.

¶ Second: The basic law of current flow. In order that this should exist there must be sufficient voltage.

¶ Third: Trouble testing by elimination. The electric circles are divided into a number of arcs by bridging across and these arcs are gone over one by one. These three principles are applied to the lighting, starting and ignition circles.

Part II—Last Week

¶ Finding trouble by symptoms in starting and lighting systems. Classifying these and indicating the possible troubles for each set of symptoms.

Part III—This Week

¶ Locating troubles by units in starting and lighting. Knowing the unit in which the trouble exists, the possible locations and causes are given in detail.

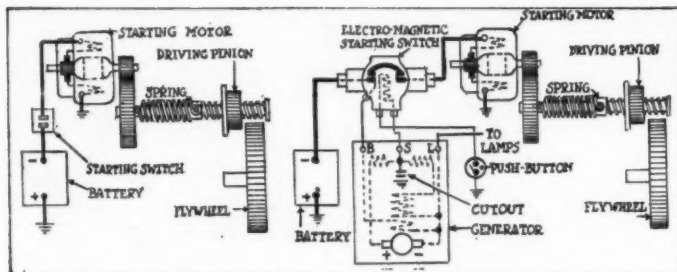
IN a large percentage of instances it will take only a minute's inspection to determine exactly in what unit the trouble is located. For instance, if the trouble is in the starting motor there may be symptoms that render it impossible for one to come to the conclusion that the trouble were anywhere else. The next step would be generally to have the starting motor removed and brought into the shop where the work could be done upon that unit.

This part of the electrical series deals with troubles which are located in a definite unit.

Basically, even if the troublesome unit is known, the matter is simply one of elimination. It is a case of traveling from the known to the unknown, step by step until finally the bad spot is reached. However, there are short cuts which can be employed on definite units which will greatly lessen the work and prevent the repairman from taking down the entire part in a search for some little defect which can probably be located by using simple tests. These cannot be classified under general heads but will be suggested in taking up the troubles which occur under their particular heads.

Units of Starting and Lighting Systems

Since all starting and lighting systems are manufactured to perform the same functions, it is but natural that they should be made up of units which do the identical work. All systems are provided with a storage battery, all have generators to maintain the current supply, all have starting motors to crank the engine, regulators to govern the rate of charging, switches to control the action of the various units and wiring to connect these units and provide a path, the circle, over which the current shall flow. Certain types of each of these units have certain inherent weaknesses and these are naturally the points watched more closely by the man familiar with the business. Again, just as in cars it very frequently happens that the first run of a certain series will have certain weak spots which are corrected in the cars



Westinghouse starting switches; mechanical and magnetic on left and right

bearing a higher serial number, so in electric lighting and starting systems the earlier developments may be electrically correct but mechanically weak, or vice versa, causing certain troubles to develop in the earlier models which do not occur in the later, and it is only fair to state that the latest developments in starting and lighting systems show a remarkable amount of attention given to these little kinks which at first were the causes of most of the trouble.*

Logically the only method by which the troubles can be taken up in detail is to take up each unit singly and, since the battery is the starting point, it is considered first.

Battery Troubles and Their Remedies

SYMPOMS that the trouble is in the battery are superficially given when the light in the car lamps burns but dimly, when the starting motor cannot turn over the engine rapidly or at all, or when the lamps turn on brightly and soon die down. Any one of these may be due to other causes, but when two or three of them come together the trouble is practically surely in the battery. The common method of testing the battery to find if it is in good condition or whether it is giving any current at all is to connect the terminals of a test lamp across the positive and negative battery terminals. When testing a three-cell battery the 6-volt lamp can be put across each cell and the light should burn dimly each time. When the test lamp lights across the terminals of two of the cells and not across the third it is an immediate indication that the trouble is in that definite locality and the battery should be immediately referred to the service station of the maker. If the cells are all weak, as is shown by no glow of the test lamp across any of the cells or only a dim light when put across the positive and negative terminals of the entire battery, it indicates that the battery is partially exhausted and it should be charged. If the charging does not increase the electrolyte's specific gravity or the voltage up to standard the trouble should be referred to a battery service station if possible. One precaution must be observed, do not run the engine with the generator in place and the battery removed without lifting a brush from the commutator. There are a few systems in which no damage will occur when this precaution is not taken, but unless you are positive the system you are working on is one of the exceptions, it is far wiser to follow this rule.

With the hydrometer syringe measure the gravity of the

*It will be interesting in passing to give an instance of this. On a certain make of generator the armature bearings were inclosed in such a way that unless the driver of the car oiled the bearings every 500 miles they ran dry. It is a well-known fact that a car owner will not oil anything that he cannot see and the result is that very soon these generators, which were driven at three times crankshaft speed and hence were the fastest moving parts on the car, soon began to come into the repair shops for bearing replacements, and often, because the bearings had worn so far that the armature swept against the pole pieces, the armatures were also frequently destroyed and required replacement. This fault was soon perceived by the manufacturers, who installed a bearing which held the lubricant so that if only oiled at long intervals sufficient lubrication was provided. Instances of this kind can be cited almost without number and on this score it can only be said that experience is the only thing which will teach a repairman the little peculiarities of the great number of starting and lighting systems which were put on the market during the early development of this method of cranking and illumination.

electrolyte and when charged the reading should be between 1.275 and 1.300 and when discharged never below 1.150. The facilities of the ordinary car owner or repairman will not allow him to do any practical work in batteries, as far as the internal construction is concerned.

Sulphation of the battery lies within the scope of the repairman as it can be generally cured by giving a long slow charge, or in other words by making the charging rate of the battery three times as slow as normal. The repairman, however, should go further than merely curing the sulphation as he should take up the inherent trouble or defect which is making the sulphation possible. Generally the causes of the over-sulphation are over-discharge or rapid discharge either of the entire mass of active material due to some exterior short or more than normal ampere draw, or from some local short which quickly discharges certain portions of the active material. Dead shorts will more than sulphate the battery as a rule and will generally cause the cracking and shedding of the active material from the plates or cause them to buckle. Insufficient charging also causes sulphation.

Batteries should be cleaned from time to time so that the sediment does not rise up to the plates, cutting down their available surface. Battery repair, however, should only be undertaken by those who have the necessary equipment and experience. One point of battery care which is important, however obvious, is that the exterior must be kept clean, and where acid has leaked out and collected on the top of the battery it must be cleaned off. It gives a slight short across the top of the battery which makes a material reduction in the supply of current after a time. In fact, acid on top of the battery will often fool an experienced repairman who knows that there is a slight short somewhere and will look for it in the wiring. All trouble searching or shooting, as it is often called, should start from the battery and work out, and before the battery is left the repairman should make sure that there is no leakage of electrolyte through the sides or top, that the terminals are not bent over touching the metal battery box and that none of the insulation of the wires is soaked with acid. Tight terminals should also be the rule, although of course this belongs more to the wiring than to the battery.

Repairs on the Generator

GENERATOR troubles can be divided into two heads, mechanical and electrical. They are often combined as a mechanical trouble will also set up an electrical interruption as a general rule. Probably the most frequent cause of generator trouble in the average type of machine is in neglect of the lubrication of the armature shaft bearings, although it is true that a number of makes are free from this due to the specific care taken to avoid this trouble. If trouble has been traced to the generator, as it can be as a rule through the fact that the ammeter reading indicates either no charge or weak charge, the first place to look is at the commutator. Removing the commutator housing, the commutator surface and brush mechanism will be exposed, giving access to what is generally the heart of any electrical troubles which might have occurred.

Commutator Assembly

With the commutator housing removed, or any other housings possible on the particular make under consideration, the armature shaft is rotated slowly by hand allowing the repairman to locate binding or worn out bearings. As the armature shaft is rotated the surface of the commutator is examined to see if it has become rough or blackened.

Since the brushes of the generator are constantly in contact with the commutator it is but natural that they should wear away, and they do so in the form of metallic powder or dust. If this is allowed to accumulate it will sometimes

fill the ridges between the commutator bars causing occasionally a short-circuit between the brush holders. A rough or blackened commutator should be cleaned and smoothed with fine sandpaper while the armature is rotated. A rule which must be remembered is that emery should not be employed for cleaning the commutator. Loose commutator bars or broken windings almost invariably mean that the machine must be returned to the factory.

A common trouble which can be cured in an ordinarily equipped shop is high mica, which protrudes between the commutator segments. These high mica parts must be cut down carefully so as to be below the surface of the commutator, and generally in doing this work it will be necessary to take the machine down. Little need be said about the work of taking a generator down except that in the case of permanent magnet types, where the permanent fields have to be removed, a keeper, or heavy piece of steel, should be put across the magnet poles in order to preserve the magnetism. In returning the magnets great care must be taken that they are replaced in the same positions as they were before.

Brush Troubles

Brushes will sometimes be found to be sticking in the brush holders, with the result that imperfect contact is made between the commutator and the brush, or occasionally no contact at all. Grease and dirt will generally be found to be the cause of sticking, and the cure is cleanliness. Should the trouble, however, be due to brushes which are too large, they can be filed carefully to secure perfect fit in the holders. Sometimes the poor contact is due to bad spring tension which does not press the brush against the commutator. This trouble is overcome by a fresh adjustment on the spring, or a spring replacement. Too much pressure, however, between the brushes and the commutator should be guarded against, as excessive pressure would cause the brushes to overheat and deteriorate.

It is not good economy to use any but the best brushes, and in making brush replacements the best policy is to secure the new brushes from the maker of the generator. Com-

mutators naturally must be clean, free from grease and bright. It is also of great importance to have a clean complete contact between the brush and the commutator.

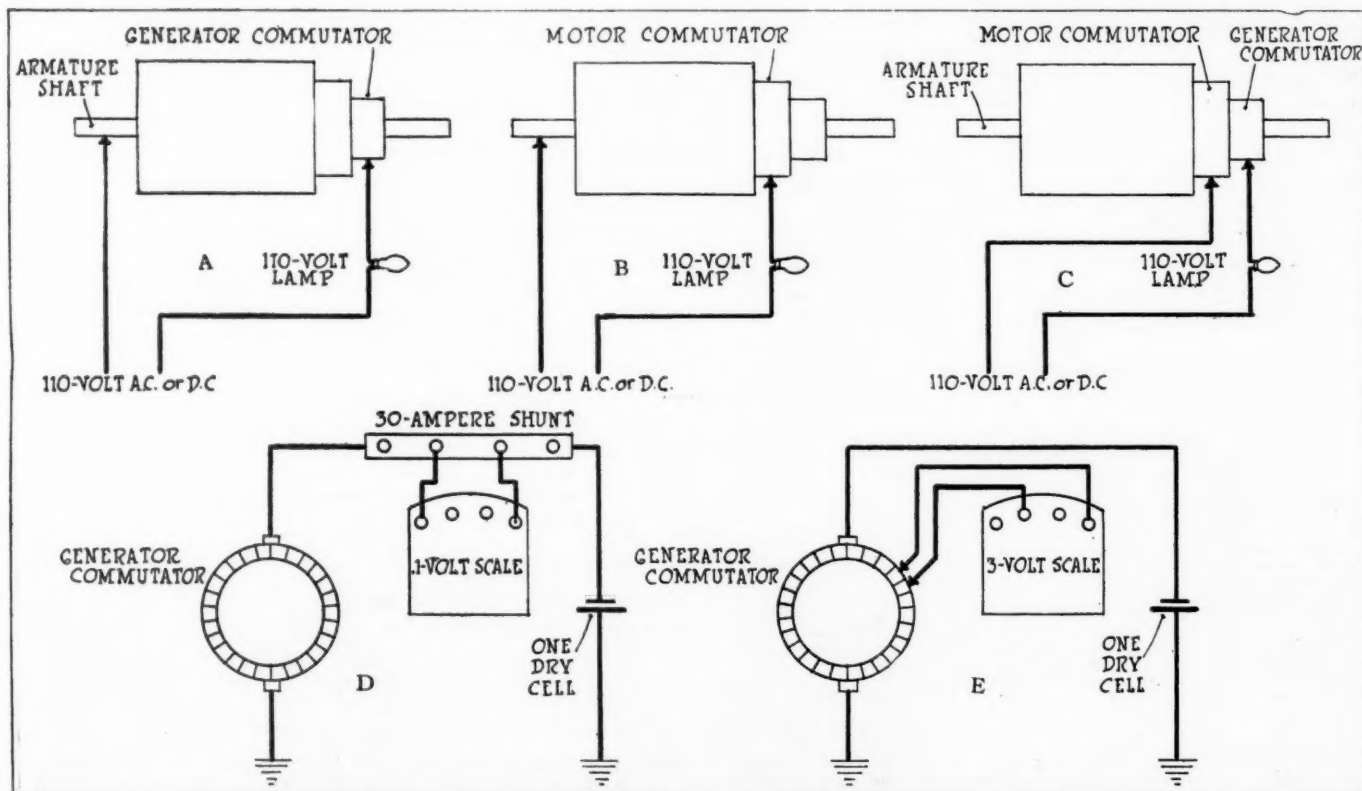
Automatic Cutout and Regulator

The automatic cutout and the regulator may be considered a part of the generator since they have so much to do with its action and since as a growing practice they are mounted directly in unit with it. The automatic cutout prevents the battery from becoming discharged through the generator when the engine is not running. It also connects the generator to the battery when it is time to charge the latter or when the car speed reaches a fixed amount.

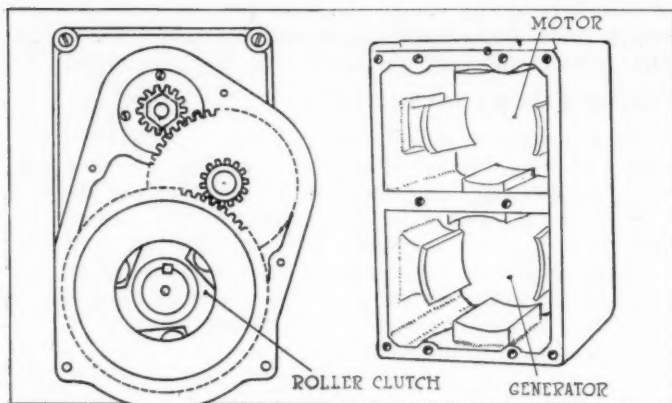
Troubles in the automatic cutout are generally those of adjustment of the spring tension or weight which acts against the tendency of the relay magnet to close the contact between the generator and the battery. On some regulators it is impossible to make any adjustment on the spring controlling the automatic cutout because the makers seal the regulators and avoid all guarantees when the seals are broken. Adjustment can be made on others by bending the flat spring carefully or by lengthening or shortening the coil springs. In general the farther apart the cutout points are separated the higher the cutting in speed of the generator. Therefore if the cutout closes at too low a speed this can generally be cured by separating the points.

Cars which are driven practically always at night require a different setting of the cutin mechanism than on cars which are seldom driven after dark, and the charging rate of the generator on a car driven practically always at night is often changed by the service manager who happens to know exactly the conditions. If a battery does not receive sufficient charge or it is continually in a run-down condition it is generally considered evidence that the cutout is not closing soon enough, provided there are no shorts anywhere on the line.

If some method of regulation were not employed the charging rate of a generator would increase rapidly with the speed, but in order to maintain the life of the battery the



Delco Tests—A—Test for grounded generator coil on one-wire single unit systems. B—For grounded motor coil. C—Short between motor and generator armature. D—Open or short-circuited generator armature. E—Generator commutator



Remy model 150 reduction gears, over-running clutch and frame

ampere flow entering it must not rise above a certain point. There are two basic methods of doing this, one by regulating the amperage of a quantity of current and the other by regulating the voltage or the pressure of the current. The voltage or pressure is what causes the current in amperes to flow. With the realization of the importance of the regulator in mind the ammeter should be carefully watched to check the charging rate.

Electric Starting Motors

WITH rare exceptions electric starting motors are series wound. This means that the current passes from the commutator through the brush, through the series field, then out through the line and back through the other brush to the commutator. Electrically, therefore, practically all starting motors are alike. Mechanically, they vary in their shape and construction and in the method by which they are connected to and detached from the gasoline engine.

Electrical troubles are very scarce in starting motors for two reasons; first because they are simple, and second because they are only in use a limited length of time in starting the engine. The mechanical troubles are in the majority of instances connected with the mechanism for throwing the starting pinion in and out of mesh. The arrangements for doing this are generally different, probably the most common method now being a magnetic scheme or by the Bendix gear. Roller clutches are also used and sometimes the starting pinion is engaged positively by pressure on the starting pedal. Where motor generators are used constant mesh machines are sometimes employed in which the machine acts as a motor below certain speeds and a generator above a given speed. Cases where the meshing mechanism fails to work are easily detected, and generally the case is one which should be treated mechanically, although in magnetic designs the solenoid should be examined to see if coils are in

good condition and are pulling the starting pinion into place.

Armature, commutator and brush troubles may occur on the motor just as in the generator, and the detailed explanations and descriptions given under the generator head may be applied to the motor. A clean commutator and proper brushes in correct adjustment are necessary to the proper performance of the starting motor the same as they are to the generator.

Wiring and Connections

A LARGE percentage of the minor troubles encountered by the car driver are in the wiring and connections. Small grounds, short circuits and current leaks are due to some defect in insulation, especially of terminals, connectors, switches, etc. Sometimes these troubles may become the cause of more serious difficulties if they are allowed to go without attention. A small ground in the battery circuit may result eventually in the sulphation of the storage battery. A worn starting switch has been known to cause a stripped flywheel gear, and thus although the trouble in itself may be only some little detail it may be serious enough to give a great amount of annoyance if it is not looked after.

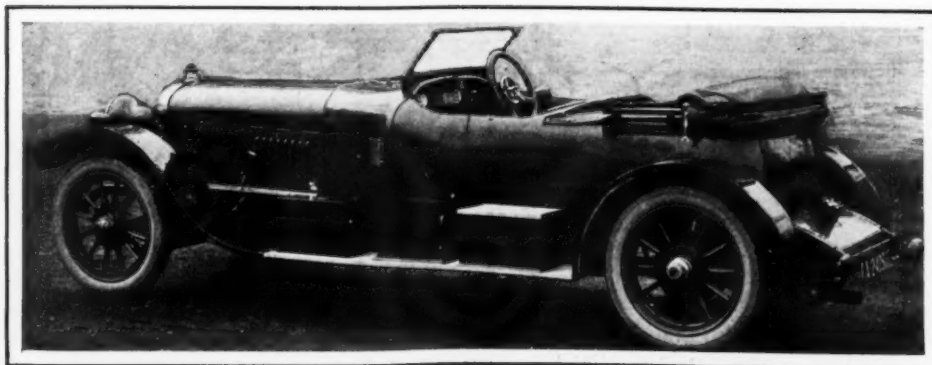
In a two-wire system in order to secure a ground, contact has to be made with both wires and some part of the frame of the car. In a single wire system any contact with the car frame gives a ground. In either system all wires should be insulated from each other except at points where contact is necessarily made, and there the connections should be soldered and taped.

Wires must be secured against chafing and therefore should be fastened securely in position. The installation should be made so that there is no possibility of sharp metal corners or edges cutting through the insulation and eventually establishing a ground or short circuit. Wherever grease and water are to be found wires should be especially protected because of the rotting action on the insulation.

With these points in mind repairs can be made after they have been found by the systematic method of search explained. Motor and car vibrations will often loosen the wiring and cause poor and intermittent contacts to be made. The connections to such units as the motor switch, dash instruments and switches, battery, generator, motor, etc., should all be so carefully made that a great factor of safety is given against possible disconnection. The contact pieces and electric switches should break quickly and not be in a position to cause arcs across the contacts thereby burning them and quickly destroying their usefulness. Switches, connectors, lamp sockets sometimes short-circuit or wear out and should be replaced. Burned-out bulbs are obvious and are the first things looked for when the lamps do not light. They form one of the little detail parts which must be constantly watched in maintaining the proper functioning of an electric lighting and starting system.

A New Sunbeam Six-Cylinder Model

THE accompanying illustration shows a new model of Sunbeam six which has been prepared for after-war business and is interesting because it shows the latest ideas in British bodywork. In general the lines are not unlike those of the Mercer, the top of the hood being fairly flat and the radiator much the same shape. The "tumble home" on the sides of the body is apparently greater than on any American stock car. The use of flt fenders is to be noticed, the domed pattern having found less favor in England and France than in America.



Building Up Sheet Aluminum Bodies

Eliminating Elaborate Hammering by Using Acetylene Welding

LAST Fall THE AUTOMOBILE described the Franklin car construction fully with the idea of showing how the light weight was obtained. Mention was made of the large amount of weight cut out by using sheet aluminum for the fenders and for the body panels. Sheet aluminum is a very ductile substance and can be bent and hammered into almost any shape, but very elaborate hammering is costly, as it is not a rapid process and calls for highly skilled labor.

Minimizing Waste of Material

It is an ideal with many body builders to-day to cover all wood completely, so as to have a continuous sheet of metal without seams or joints all over the outside of the body. This can be done in steel when there are no elaborate curves, and in aluminium for almost any shape, but the modern trend is toward the use of several pieces of the covering sheet metal, welded together so as to avoid the joint without the necessity for wasting much sheet in cutting out or for difficult forming operations.

Welding Franklin Cowl

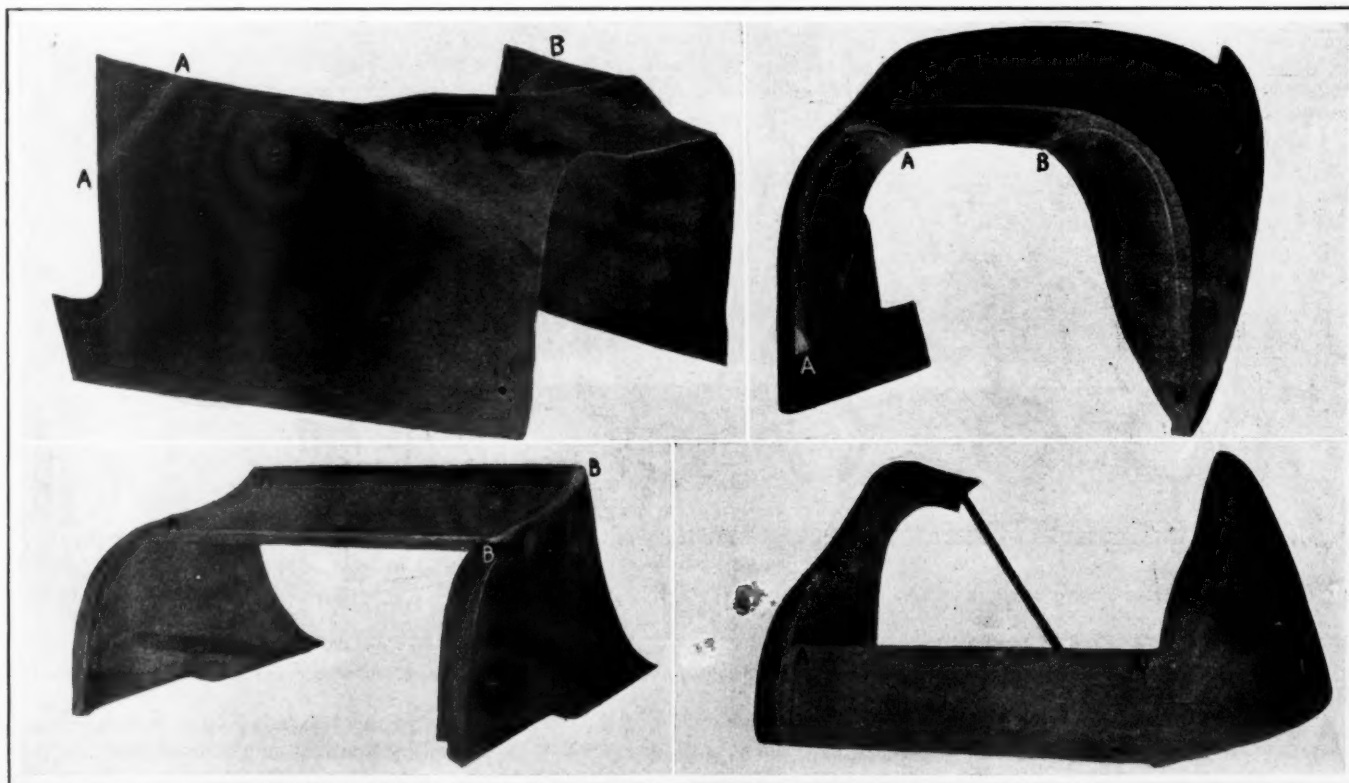
The Walker-Wells Co., Amesbury, Mass., is doing some interesting welding work on the Franklin bodies, with economy of production, excellence of jointing and avoidance of the need for much hammering as the aims, and some of the work is shown in the accompanying illustrations. A striking

example is the Franklin cowl. This formerly presented many difficulties, owing to the very large amount of metal needed on the front to form the face of the dashboard where the hood junction occurs. Now, the cowl is hammered to shape to get the top and sides, but very little metal is turned over in front. Two pieces of metal are then cut to shape and welded in by a Prest-O-Lite outfit, using the "baby" or type G blowpipe. That the work is very rapid is shown by the time taken for this job, seven minutes, the length of the weld being 60 in.

Roadster Rear Boot a Problem

Another awkward piece of body metal is the portion covering the rear boot on a roadster. This has a curved top and two curved sides which are now made in three pieces and mounted upon a jig. When thus rigged up from five to eight minutes suffice for completing the weld. This particular design of boot could scarcely be covered with a single sheet of metal prepared any other way as it would be an almost impossible hammering job to make a piece of the required shape.

The system of welding small pieces together is adopted by the Walker-Wells Co. for other jobs besides the Franklin bodies; one of the Winton inclosed bodies is made on this plan with great economy of time and material, and many other examples could be mentioned.



Some excellent examples of acetylene welding work in the building of sheet aluminum bodies. Upper left—Small pieces of aluminum sheets welded to corners of sedan cowl, saving a considerable amount of material in the layout of this pattern. The welds are indicated by the letters A and B. The time required for the operation was five minutes.

Upper right—Front panels welded into the Franklin cowl to meet

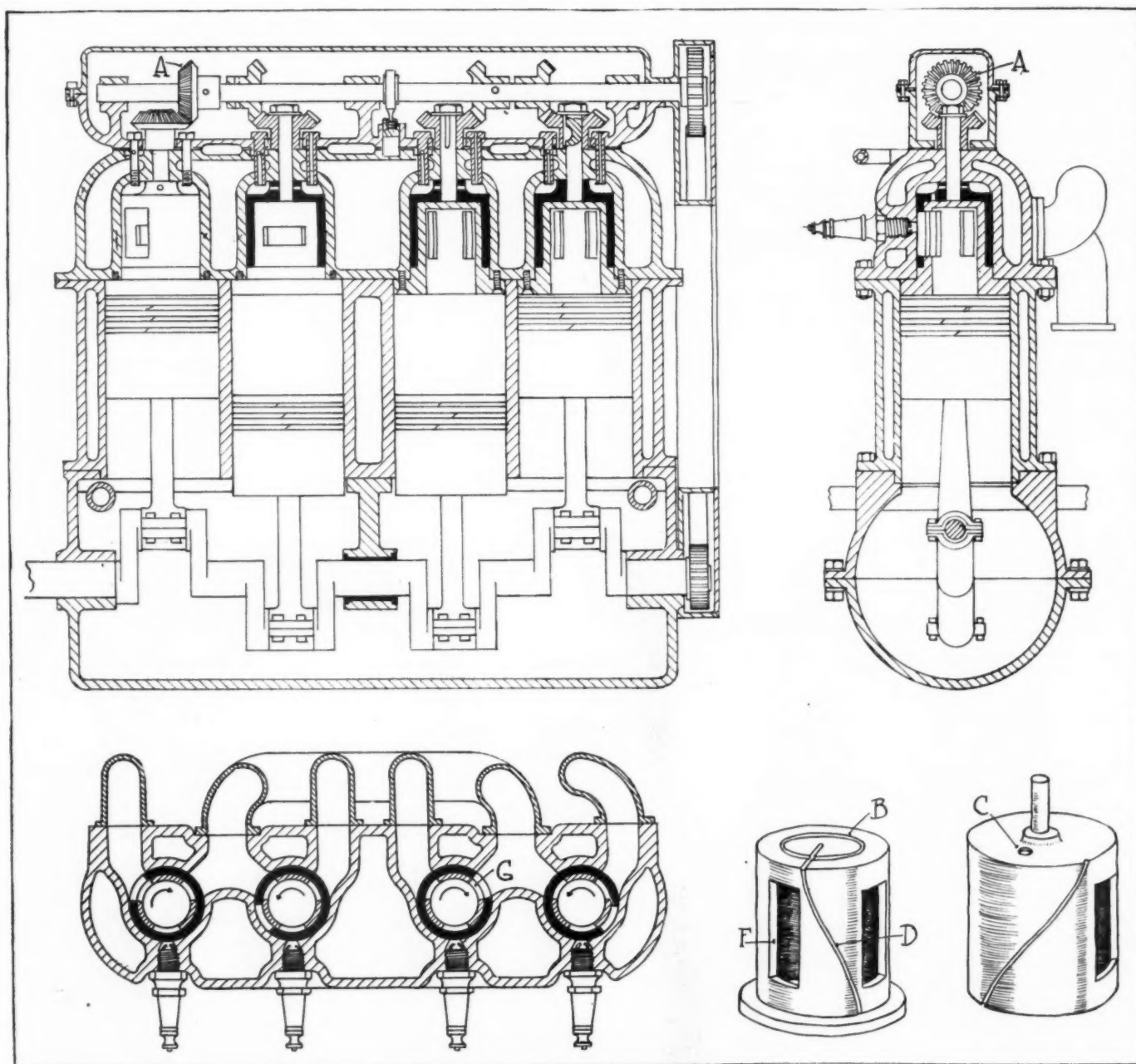
the lines of the sloping hood. Two welds are indicated by the letters A and B. This operation was completed in seven minutes.

Lower left—Another view of roadster rear boot. This operation was also carried out in seven minutes, the two welds being indicated by the letters A and B.

Lower right—Rear quarter panels of Franklin roadster which were welded at A, the work being done in four minutes.

Schofield Motor Employs Inverted Cylindrical Cup Valve

All Valve Parts Rotating—Combustion Chamber of Smaller Diameter Than Cylinder Proper—Balance Valve Construction



Sectional views of the Schofield rotating inverted cylindrical valve motor, showing details of valve operation and construction

A ROTATING sleeve motor which incorporates a number of novel features is being developed by George L. Schofield, Kansas City, Mo. The motor does not differ from ordinary practice anywhere in the assembly between the bottom of the crankcase and the top of that part of the cylinder swept by the piston. Above this point, however, incorporated in the superstructure necessary with this motor, is the valve action. The valve proper is an inverted cylindrical cup pierced by rectangular openings which form the

ports. Each of these valves is carried on a vertical stem or shaft which is rotated by a single longitudinal shaft.

Referring to the sectional and diagrammatic illustrations herewith, it will be noted that these inverted cylindrical valves rotate within an annular space provided for them above the main cylinder. The space within the valve chambers forms the combustion space of the motor so that the combustion space is of smaller diameter than the expansion chamber in the cylinder.

Referring to the plan views, it will be seen that the interior wall of the combustion chamber is pierced by three ports, one for intake, one for exhaust and the third at the spark plug opening. The rotating valve itself contains only one port, and when this single port is in line with any of the three in the interior wall of the combustion chamber, as at *G*, either exhaust, intake or firing takes place.

As the valve is rotated from the longitudinal shaft by means of the bevel gears *A*, the port comes in line with the intake opening, allowing a charge of gas to pass in through the openings in the rotating valve which is shown in solid black in the sectional illustrations. This charge then passes through the opening in the inner wall of the combustion chamber and at the proper time the intake is closed when the valve port no longer registers with the intake passage.

The piston then moves up on its compression stroke while the valve is rotating until when the firing point is reached the valve opening registers with the spark plug opening and firing occurs. Immediately after this takes place the spark plug is cut off from contact with the hot gasses and the valve moves around until it finally registers with the exhaust port, allowing the gas to escape into the manifold and the pressure in the cylinder to fall to atmospheric.

Pressure Feed Lubricates Valve

The valve must be lubricated on two surfaces, since it rotates within an annular passage and this is accomplished by a pressure feed which forces the oil down on to the top of the valve where it enters a groove cut down along the side of its cylindrical surface, thus taking care of the exterior wall. There is also a hole *C* cut in the top of the valve, allowing oil to enter into the groove *B*. From here it is led through

the groove *D* to the inner surface of the valve wall providing a lubricating film at this point.

The construction used with this motor allows the entire head to be taken off, exposing the cylinder walls. The internal valve member *F* is bolted to the superstructure and is removed with it. The advantage of accessibility is claimed for this construction.

As regards balance of the valve this is obtained by the arrangement of the ports which permits equal pressure on all sides. The engine is also said to run cool due to the great amount of water space surrounding the combustion chamber and the fact that the gas is allowed to expand into a separate chamber below. Thus there is a much greater amount of water around the combustion space where it is needed than there is around the expansion chamber where there is a desire to conserve the heat to as great an extent as possible.

Valve Mechanism Is Chain Driven

The arrangement for the valve drive is simple and in the drawings consists of a silent chain drive to the longitudinal shaft above. In order that the engine may be balanced mechanically the adjacent valves rotate in opposite directions. There is no reciprocating action in any of the valve parts, the entire cycle being accomplished by rotation.

A study of the details of construction in the illustrations herewith shows the valve driving mechanism to be mounted at one end of the motor taking the silent chain drive from the end of the crankshaft. The longitudinal valve shaft is carried on three bearings. The lubricating pump is operated from the valve shaft supplying oil under pressure to the oil distributing grooves in the valves. The entire valve drive mechanism operates in a bath of oil, allowing the top of the motor containing the bevel gears to act as a reservoir.

Benninghofen Engine for Small Plants

A SINGLE-CYLINDER, four-cycle vertical gasoline engine intended for power purposes in small plants or as an auxiliary in large plants, has been brought out by C. Benninghofen & Sons, Hamilton, Ohio. This is a throttle-governed engine developed to supply the demand for a small, efficient unit capable of operating at a uniform speed at low fuel consumption.

To secure close regulation and speed, it has been found necessary to use liberal weights in the flywheels and also to control carefully the amount of fuel admitted to the cylinder. This dual condition has been met by the use of the Benninghofen throttle governor which is designed to be sensitive and to hold the fuel consumption down to the minimum. An example of this is given by the company, which states that these engines have been known to operate continually for 7 hr. and 40 min. on 1 gal. of gasoline.

The uniform speed of the engine and its low operating cost make it adaptable for driving generators in connection with small lighting plants, and the function of regulation is performed entirely by the sensitive governor, so that the lights can be burned from the generator without showing variations in brilliancy.

Besides the throttling governor the engine has other novel features, among which may be mentioned the

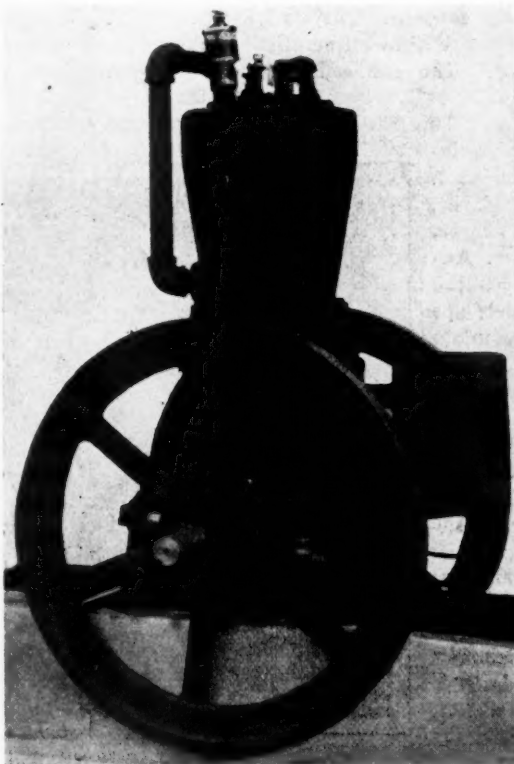
force-proof cooling hopper; the solid cast-iron fuel tank forming a part of the engine; the quickly-removable cylinder head with valves and spark plug as well as other features. Each engine is supplied with a priming cup to facilitate starting.

Its weight with complete equipment, including battery, coil box, coil, plug, carbureter, skids, etc., ready to run, is 475 lb. The price is \$35 f.o.b. Hamilton, Ohio. A table of specifications is given herewith.

| | |
|---|--------|
| Brake hp. | 2 |
| r.p.m. at which power is developed | 450 |
| Maximum r.p.m. | 600 |
| Stroke | 5 in. |
| Bore | 4 in. |
| Overall length skids..... | 40 in. |
| Overall width | 31 in. |
| Overall height | 42 in. |
| Solid driving pulley, 4-in. face by 8-in. diam. | |

Flywheels (2) face.....1½ in.
Shipping weight500 lb.

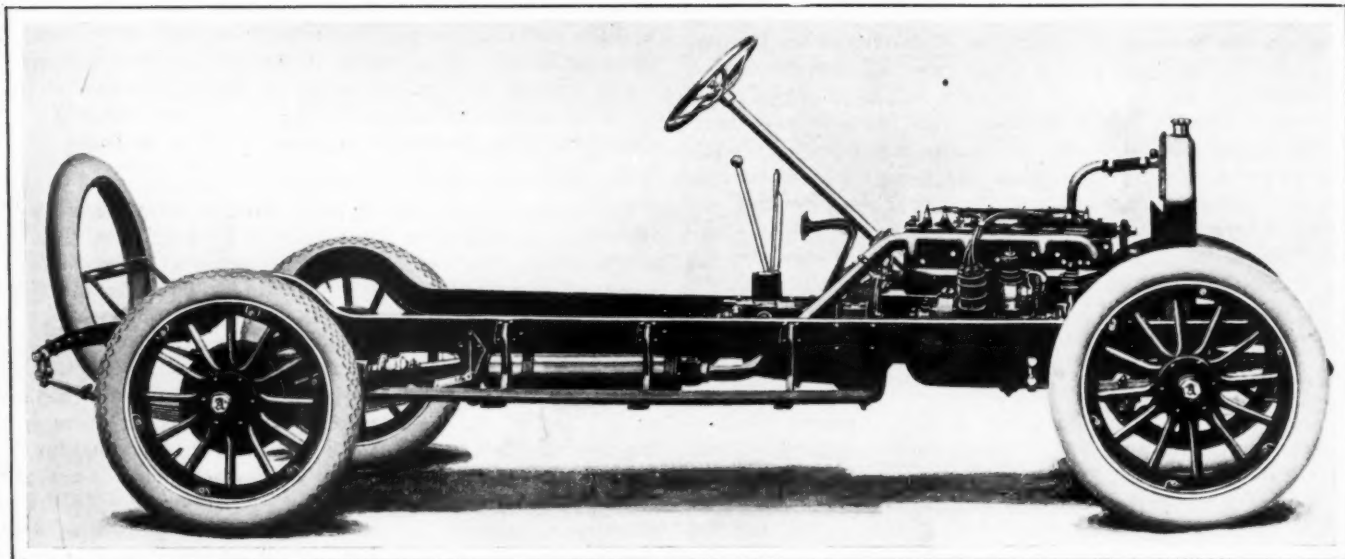
For engines like the Benninghofen there is a much larger field than is realized by the majority of people. An engine built with solid proportions intended for stationary use is nearly always a much more efficient and economical power plant for a small shop or for farm work than the old automobile engines so frequently used. For a stationary engine reliability and economical running are the first essentials.



Benninghofen stationary gasoline engine

Anderson Six a Southern Product

Good Units Assembled in Neat Chassis with Extra
Lavish Equipment



Anderson six chassis made by Anderson Motor Co., Rock Hill, S. C., showing frame kick-up over rear axle

A NEW car manufactured in a new territory as far as the automobile industry is concerned is announced under the name of the Anderson 6-40. The manufacturer is the Anderson Motor Co., Rock Hill, S. C., and the officers of the company are members of the Rock Hill Buggy Co., which company has been in business for a number of years manufacturing buggies and wagons.

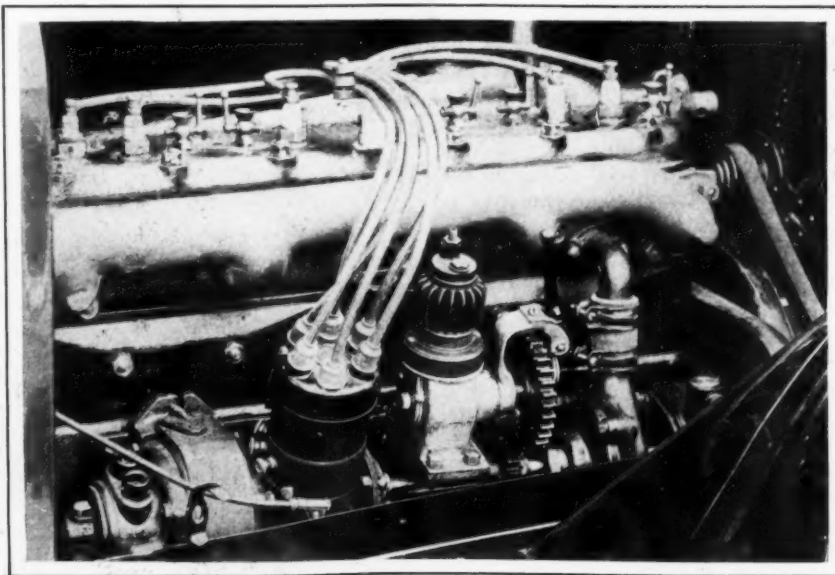
The new car is an assembled design worked out by Joseph A. Anglada, who is chief engineer of the concern. The work on the car has been going forward for about eighteen months and production has now been started. The car sells for \$1,250.

Probably the most noteworthy feature of the car is in the fact that it is unusually complete in its equipment. The standard car is fitted with a power tire pump, searchlight, trouble light, cigar lighter, Motometer and tonneau heater, all as regular equipment at the list price. Another feature is the arrangement of the crowned fenders and mudguards which are manufactured together with the complete bodies in the factory of the Rock Hill Buggy Co. A thoroughly up-to-date job has been done in the upholstery and in the seating arrangement which incorporates divided front seats with an intermediate extra seat just behind and a roomy three-passenger seat in the rear. This gives a seating capacity of six in the touring car.

The roadster has a capacity of four passengers, and even five could be seated without excessive crowding. This is accomplished by using a folding seat in the rear which can carry either two or three persons as desired. The roadster, and the touring car as well, have an individuality of coloring which is unusual, the touring car is dark brewster green

body with the fenders, etc., black. There is a red pen stripe around the body. On the roadster the color of the body is a khaki gray with dark brown fenders giving a contrasting appearance. The price of the roadster is the same as that of the touring car.

Standard units are used throughout the mechanical construction of the car. The motor is the Continental six-cylinder $3\frac{1}{4}$ by $4\frac{1}{2}$ -in. L-head type. The S. A. E. horsepower rating is 25.35 and the piston displacement 224 cu. in. The valves are on the right side and are operated through a helical gear drive. Cooling is by pump and oiling by splash pressure with the oil carried in the usual way in the lower part of the crankcase with pressure feed to the main bear-



Layout of Westinghouse generator-ignition unit and tire pump on Continental motor

ings. The cylinders are taken care of by splash. The oil is circulated by a piston type pump.

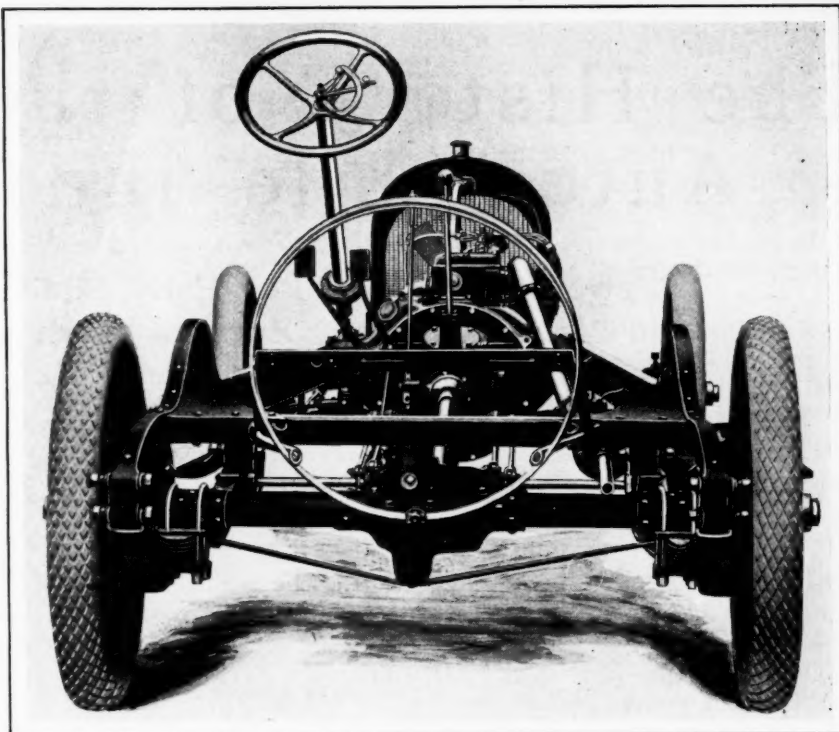
For carburetion and ignition standard units are used, the Zenith instrument being used on both touring and roadster for carburetion and the entire car being Westinghouse as far as electrical equipment is concerned. The Westinghouse two-unit system is used, operating at 6 volts for starting, lighting and ignition. Ignition advance is automatic, and the system is thoroughly outfitted with ammeter, dimmer switch, etc. The storage battery has a capacity of 80 amp.-hr., the electric horn is motor-driven, and armored cable is used in all the wiring. Other electrical instruments used on the car are the cigar lighter, searchlight and trouble light.

Tire Pump Under Hood

The power tire pump is mounted on the right side of the motor with a sliding gear engagement operated by a hand lever easily accessible on raising the hood. The drive for the tire pump is taken off the water pump shaft which also provides drive for the generator.

The clutch is a Borg & Beck dry disk type, 10 in. in diameter. It transmits the power through a three-speed selective gearbox to an Anderson-Mott floating axle. The front axle is also an Anderson-Mott of reversed Elliot type. The springs are semi-elliptic designed to be flat under normal load. They have phosphor bronze bushings for $\frac{5}{8}$ in. bolts in the spring eyes. The front spring has 5-in. play, being 36 in. in length and 2 in. in width. The underslung rear spring has a maximum play of 8 in. and is 56 in. long and 2 in. wide.

The frame construction is simple, being composed of two main members which taper in straight lines from the rear



Showing ample proportions of underslung rear springs on Anderson six

of the car forward. There is a cross member just behind the radiator and another at the rear. Both of these are rigidly connected to the side members by gusset plates. The rear support of the unit power plant and the radiator supporting members also act as virtual cross members, giving the frame construction rigidity although having but few actual parts and consequently being clean and light. The front support of the motor is hung in the front cross member of the frame, giving a three-point suspension of the unit power plant.

Wheels are twelve-spoke types of selected hickory. Spokes are $1\frac{1}{8}$ in. wide, and on the rear wheels are 14-in. brake drums. The brakes themselves are completely inclosed within the drums, being of the internal expanding type. The brake linkage is equalized through an equalizing bar which is placed some distance forward of the rear axle.

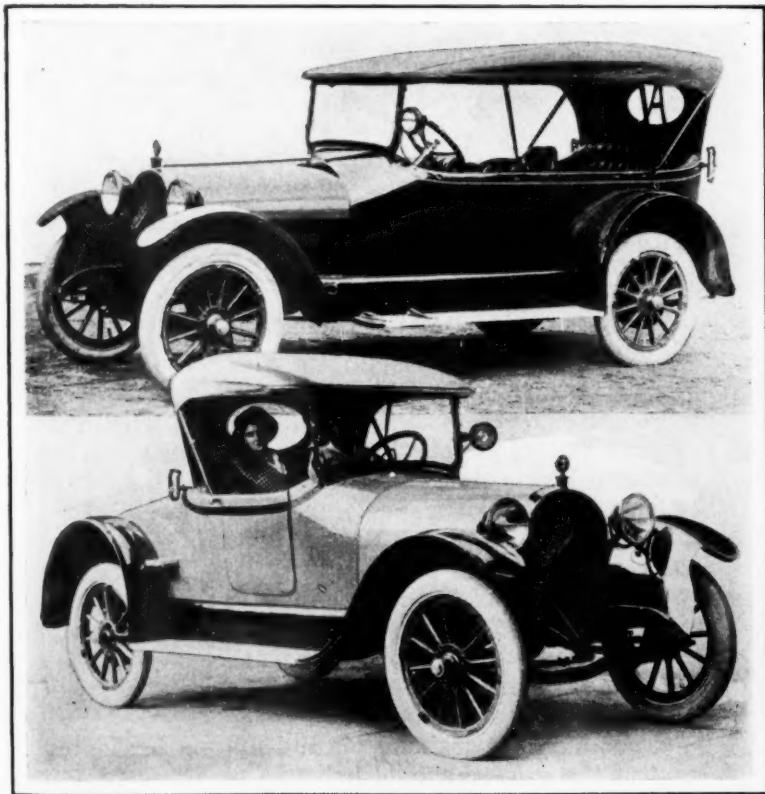
Hotchkiss Drive

Hotchkiss drive, in which both drive and torque are taken through the rear springs, is employed. This simple type of drive taken in connection with the chassis layout, gives a clean design which should tend to keep the car free of rattle. The speedometer drive is also rattle-proof, being strongly mounted just behind the gearset.

Besides the special equipment mentioned, the car has quick-demountable rims, one-man top, crown fenders with complete splash guards, ventilating windshield, speedometer, hand pump, repair kit and a complete set of the usual tools.

Seats Are Comfortable

The illustrations of the complete touring car and the roadster show that handsome appearance has not been sought in vain. There is ample depth in the rear seat, despite the very low appearance of the side. It will be noticed that an exceptional amount of clearance is allowed between the rear axle and the frame, this giving the rear springs an abnormal amplitude of movement and so making for easy riding over very bad roads.



Both touring car and roadster sell for \$1,250

The History of the American Automobile Industry—26

Petroleum Mentioned by Early Biblical Writers—Used in Mexico in 16th Century—Washington Appreciated Its Value—Gasoline Considered a Nuisance by Salt Men

By David Beecroft

THE earliest Bible writers make references which cannot be other than petroleum. In Genesis 14, "The Vale of Siddim was full of slime pits," refers to a method of collecting the oily liquid that has been practised in all parts of the world.

"Oil out of the flinty rock" (Deuteronomy 32), and "the rock poured me out rivers of oil" (Job 39) were not many years ago so certainly impossible as to be held up by skeptics as proof of the falsity of the Good Book, but, with the knowledge of today, they are seen to be plain statements of probably well-known things.

Other Early References

Many ancient writers mention or describe petroleum in no unmistakable language. Pliny and Dioscorides both mention the use of oil in Italy which was burned in lamps, the latter saying, "the people of Argrigentum save oil in pits and burn it in lamps." He also mentioned it as being called Sicilian oil. There seems to be no doubt that its use in embalming in Egypt extends back fully 2000 years B. C., and it is stated that mummies and their wrappings have sometimes been used by the Arabs for fuel. The use of petroleum for heating purposes is unquestionably quite old even though of limited application, but its use for power and as a lubricant now so common and extensive is of course a recent matter.

Its Use in Mexico

In 1520, Friar Sagahim, in writing of what he saw in Mexico, says Chapopote is sold in the Mexican markets; is collected from the sea, and in Yucatan is used to build with, and his description makes it plain that this was a petroleum product, which we can quite well believe, knowing the enormous Mexican fields now developed.

More than a century later A. A. Barbou, writing at Potosi in 1640, describes La Naphthe or Oyl of Peter, Rock oil, which was sometimes white and sometimes black and which had the peculiar property of drawing fire as a lodestone draws iron or steel. He cites an interesting example of this latter property in which a certain well polluted by the leaking of the oil through its walls into the water, was ordered repaired and a laborer sent

down to stop the leak by which the oil entered. He asked for a light and a "lanthorn" being sent down to him, the oil drew the fire through the holes of the lantern and caused the well to discharge itself like a huge cannon with much noise, killing the laborer. The vividness of this account leaves no doubt in modern minds as to its correctness, but it must have excited some wonder in those days.

In what is now the United States there were many early mentions of oil springs. In 1629 Father d'Allion, a French missionary, mentioned a spring near what is now Cuba, N. Y., and a map prepared by French missionaries in 1670 shows a "font bitume" in the same locality. In 1757, the commandant located at Ft. Duquesne, now Pittsburgh, wrote his superior, concerning a fete of the Seneca Indians which he had attended some distance up the river and at which they set the river afire by igniting oil floating on its surface. Ten years later Sir Williams Johns described the Cuba spring in Alleghany county, N. Y., and David Leisberger, a Moravian missionary, also in 1767, gave an account of the petroleum springs and explained that there were three kinds, one of which gathered oil by seepage on the surrounding higher ground, another which flowed out of the earth and dissipated itself by running away and being absorbed, while a third showed the oil coming out and flowing away with water as if it came from beneath.

Washington Appreciated Oil Land

In 1775 George Washington took title to three tracts of land in the Ohio valley and in his will instructed his heirs not to sell the one on the Kanawha River which contained the bituminous spring because he considered it of great value. In 1783 General B. Lincoln's soldiers used the oil they found along Oil Creek, Pa., to bathe their joints, and otherwise, as a medicine. The *Philadelphia Gazetteer*, the first of its kind in the United States, published in 1795, tells of Oil Creek and bitumen springs having a capacity of several gallons of oil per day which was deemed good for a variety of complaints.

That any one desiring oil and finding it seeping out of the ground should hollow a pit into which it might collect is but natural, so no wonder need be

felt that we find oil pits wherever we find oil, but the early discoverers reported that along Oil Creek they found numbers of pits some 6 or 8 ft. and probably 12 ft. deep lined with rough hewn logs and filled with debris in which trees had grown up whose rings showed an age of several centuries. These remains seemed to indicate that an older and higher civilization than the Indians knew of these petroleum sources and used them. The Indians and early settlers would gather the oil floating on the top of the water in these pits by scraping it up on a piece of wood and transferring it to a pot or by dipping a blanket into it and wringing it out. They removed the coarser dirt by straining or by heating the oil and permitting it to settle.

Draining Away Gasoline

The white settlers seemed to find no greater use for petroleum than their Indian predecessors, until it forced itself upon their attention in connection with their salt wells and even they failed to take the hint. Beginning with about 1808, the production of salt by boring until brine was found and then evaporating the brine became a considerable industry. Buildings, bridges, fences and even roads

were built of wood. Timber was plentiful and saw-mills became quite common. Sawing wood requires considerable power, however, and the engines were usually of the cheapest construction and non-condensive, so they were throwing much valuable heat in the exhaust steam and to use this in the evaporation of brine involved very little expense. Although their well casings were of wood, wrapped with leather at the joints, and packed inside the wrapping with flaxseed which, when wet, expanded and made a perfectly tight joint, and their other drilling and well apparatus were equally crude, these pioneers were quite successful in their boring operations. A well, 475 ft. deep, was drilled in 1814; in 1818, before reaching the brine layer, oil was struck at 171 ft. and gushed forth in such quantity as to make considerable trouble. The much disgusted owner dubbed it Devil's tar, and drained it into the nearest stream, down which it floated to the Cumberland River, 35 miles away. On one occasion a spark from a passing boat was supposed to have set it afire and the whole 35 miles blazed up. So common did the presence of oil on the surface of the water become that one stream was called Old Greasy.

Truck Club Holds Military Run

WITH the idea of eventually organizing motor truck owners to render transport service if national necessity should arise, the Motor Truck Club of America on April 8 and 9 conducted the first of what may develop into a series of military test runs over the roads of southern New York

and northern New Jersey. This run was the club's first act as an arm of the Automobile Reserve Corps.

Carrying a net load of 20 tons, six heavy trucks and seven touring cars covered 65½ miles in 10 hr. and 36 min., running time, in spite of a severe blizzard and other difficulties.



1 and 2—Commissary truck tries to pass an emergency truck and runs into the ditch. Trucks 1 and 5 haul it out with tow lines. 3—Four bad hills ranging from 8 to 14 per cent grade are encountered in succession on Palisade Avenue, Englewood, N. J., on the way to the ferry. 4—The trucks making their way down the long hill to the ferry which brought them back to New York

Alloys To Resist Corrosion

British Institute of Metals Issues Report on Bronzes and Similar Alloys—Valuable Data for Manufacturers of Marine Engines and Parts of Hydro-Aeroplanes

LONDON, ENG., April 10.—The third report to the Corrosion Committee of the Institute of Metals is a volume of some 127 pages. It records work on the corrosion of condenser tubes that has been done with the institute's experimental plant at Liverpool. To condense the mass of practical information contained in the report is not an easy matter, for even the author's summary runs to seven pages, a paper in itself.

However, in default of reproducing this summary of results it may briefly be recorded that the sea-water corrosion of ordinary brass, 70 per cent copper, 30 per cent zinc, at 30 deg. C., 50 deg. C., and 60 deg. C., has been compared with that of Admiralty metal (70:29:1), a special lead-brass (70:28:2), phosphor bronze (96:4) and aluminum-copper (92:8). It is found that aluminum-copper dissolves more slowly than the brasses. The phosphor bronze dissolves more rapidly than the brasses. In each case both hard drawn and annealed test-pieces of the alloys were used. Generally speaking, the hard drawn metal dissolved less rapidly than the annealed but is more readily attacked locally and selectively.

Aeration of the sea-water accelerates the rate of corrosion, more especially at the lower temperatures.

Corrosion in gently aerated diluted sea-water (e. g. estuary water) has been examined in some detail. The rate of solution of each alloy is diminished by diluting the sea-water, but the degree of selective corrosion is greatly increased. It is found that the rate of solution of pure copper is diminished by diluting the sea-water and is least in distilled water. That of pure zinc is greatly increased by diluting the sea-water and is greatest in distilled water.

Diluted sea-water also facilitates the formation of deposits of oxy-salts of zinc upon the surface of the metal. These oxy-salts are found to promote local selective corrosion. In diluted sea-water the phosphor bronze is the most satisfactory of the alloys considered.

The corrosion of the above-mentioned five alloys has also been examined in distilled water saturated with carbon dioxide at 30 deg. C. and 50 deg. C., and in a 0.15 per cent solution of common salt, at 30 deg. C. and 50 deg. C. Dezincification is promoted by a low concentration of salt and by a relatively high concentration of carbon dioxide.

Contact with coke is found to promote dezincification of the Admiralty metal, provided that good electrical contact exists between the metal and the coke. Under service conditions good contact is probably the exception rather than the rule.

The influence of the surface condition of the metal has been investigated and is shown to be important during the early stages of the corrosive attack. The corrosion of 70:30 brass has been compared with that of pure zinc and copper.

The report contains a section which is devoted to a consideration of the bearing of the results of the experimental work upon the practical problem.

Tin-Aluminum-Copper Alloys

Two papers were recently given before the institute, dealing with alloys of aluminum. The first, by A. A. Read and R. H. Greaves, describes a number of tests made on tin-

aluminum-copper alloys containing varying quantities of tin and aluminum (up to 10 per cent of each) and led to the following conclusions:

The replacement of tin in gun metal by aluminum is of no advantage but leads to loss of strength and greatly increased brittleness, unless about three-quarters at least of the tin is replaced when the properties approximate but are inferior to those obtainable from aluminum and copper alone.

The addition of tin to the 10 per cent aluminum-copper alloy is accompanied by a rapid increase in hardness and brittleness, while the addition of aluminum to the 10 per cent tin-copper alloy has a similar, but for small percentages, a less marked effect.

The difficulties in hot working the ternary alloys are greater than those experienced with bronzes, and very much greater than with the aluminum-copper alloys.

Corrosion both in fresh and sea-water is small, but the alloys rich in tin tend to become pitted.

The second paper, by W. H. Withey, deals with methods for the analysis of aluminum. It describes methods for the analysis of alloys of aluminum and copper, also aluminum and zinc, and gives details of a method that was used for the complete analysis of metallic aluminum. This latter method is made use of in the analysis of alloys of aluminum containing magnesium for which purpose it possesses distinct advantages, owing to the fact that large quantities of the alloy may be used in the analysis.

In this method use is made of the fact that tartaric acid is capable of preventing the precipitation of aluminum by ammonium sulphide, while at the same time zinc and nickel are quantitatively precipitated. Manganese is only partially precipitated. The filtrate left after the removal of the sulphides produced by sulphuretted hydrogen in acid solution, and by ammonium sulphide in alkaline tartrate solution is acidified and concentrated. The solution filtered from sulphur is made ammoniacal and the magnesium precipitated with sodium phosphate. The precipitate is redissolved. The precipitate is next dissolved in dilute nitric acid and any manganese, which is usually present, determined by a colorimetric method and calculated into the equivalent weight of manganese pyrophosphate which is then deducted from the magnesium pyrophosphate obtained. The manganese is separately determined in another sample.

The paper contains analyses of solutions containing aluminum and known amounts of iron, zinc, magnesium, and nickel, from 0.25 to 1.0 per cent. The results obtained indicate that the method is very reliable.

The figures obtained in the analysis of an alloy of a well known type are also in excellent agreement with those made by a standard method.

The method recommended for the analysis of the alloys of aluminum and zinc consists in adding to the solution an excess of caustic soda. The hydroxides first precipitated are thus dissolved and on passing sulphuretted hydrogen the zinc is precipitated. The precipitate is dissolved and the zinc, after the removal of traces of aluminum, is determined as phosphate.

To obtain a perfect separation certain precautions are necessary, which are fully discussed in the text.

The FORVM

Using Two Gear Ratios for Official Tests

By E. H. Delling

Chief Engineer The Mercer Automobile Co.

I WAS very much interested in the speed and acceleration tests which were made on Sheepshead Bay Speedway with a Hudson stock car and, therefore, procured a copy of the report of the A. A. A., under whose supervision these trials were made. To my greatest surprise I glean from this report that two different gear ratios were used in the respective trials, namely a 4.454 to 1 gear ratio for the acceleration test, and a 3.5 to 1 ratio for the speed test. This most important fact, however, is not revealed in any of the advertisements published by the Hudson Motor Car Co., and the public is, thus, misled into the belief that any individual Hudson stock car can duplicate the performances in question. If the Hudson company desires to use for advertising purposes the acceleration that was obtained with a 4.454 gear ratio, it should also have ascertained—and stated in its advertisements—the maximum speed which its cars are capable of doing with said gear, and further give the acceleration of its cars with a 3½ to 1 ratio. In view of the fact that the Hudson company states in all its advertisements that the tests in question were made under A. A. A. supervision, I am of the opinion that the A. A. A. should compel said company to mention all facts pertaining to these trials, and not lend its name to mislead the public into a belief which gives the Hudson Motor Car Co. an undue advantage.

Facts About No-Differential Trucks

By Arthur M. Laycock

Chief Engineer Sheldon Axle & Spring Co.

THE idea of operating without a differential is not new. It has been successfully used on racing cars for a good many years, but in the commercial field, it has not been used to any great extent, particularly in the heavier sizes.

The following advantages of this type of drive must be particularly interesting to truck users at this time:

- First—Positive pull on two wheels.
- Second—Greater tire mileage.
- Third—Less wear and tear.
- Fourth—Gasoline economy.
- Fifth—Dependability.
- Sixth—Simplicity.
- Seventh—Weight.
- Eighth—Price.

Positive Pull on Two Wheels

The positive pull on two wheels can only be appreciated by the truck user himself. Nothing is more exasperating than getting in a mudhole with one wheel only and that wheel begins to spin while the other is on perfectly good ground. In order to get traction, chains are run around the tires, which in a good many instances only digs the hole deeper until finally jacks and planking have to be used in order to

USE OF TWO GEAR RATIOS IMPORTANT ELEMENT IN TESTS—BATTERIES FREQUENTLY OF TOO SMALL CAPACITY—DISPLACEMENT, GEAR RATIO AND FUEL CONSUMPTION

get the truck out. If the positive drive is on both wheels, the one wheel on good ground will invariably pull the truck through a very bad place, and this construction absolutely prevents any spinning of the wheels when starting under load.

It is a well known fact in Europe at the present time that the conventional differential on the Army Service Corps trucks will be a thing of the past. Some form of positive drive or locked differential will be called for on the various subsidy specifications. We prophesy that a little cross country work in Mexico with the United States Army Service Corps will bring about the same thing.

Greater Tire Mileage

One has only to imagine a truck operating under shell fire and extremely muddy roads and the truck becoming mired when questions of greater mileage, less wear and tear, gasoline economy, etc., are of infinitesimal value as compared to the truck getting from one place to another positively, but when the greater tire mileage, wear and tear and gasoline economy are even questionable, one really cannot see any serious objection to cutting out the differential. The conditions with the average business man are just as vital and important and almost analogous to trucks operating under war conditions.

Quite a few of our best racing cars have been equipped with solid rear axle, the claim being made that the action of the spinning of the wheel when in the air is very much more detrimental to the tires than the little slippage on rounding a corner on the racetrack. Similar conditions exist when running a solid tire in heavy truck service over rough cobblestones. Any close observer driving behind a truck under these conditions will invariably be able to see under the tires without any difficulty whatever. At the moment these wheels are in the air they must of necessity accelerate and come down on the road at a different speed from which they left, grinding off the rubber to a much greater extent than when rounding corners with a blank differential where the slippage is uniformly distributed throughout the entire periphery of the tire.

In truck service, with the limited experience we have had with the blank differential as compared to any other, it is noticeable that the temperature rise in the tires is very much less when rounding corners under severe loadings with the solid axle than the spinning action of the wheel in a mudhole with the regular differential.

The tire wear, of course, is largely a question of heat units. It is quite a common sight to see a heavy truck in difficulties with the tires smoking from the spinning action of the wheel on soft ground.

There is certainly less wear and tear with the blank differ-

ential on engine and all running gear when one wheel partially leaves the ground, due to the irregularities of the road aforementioned.

This variance is felt throughout the whole chassis, from the engine clear back to the rear axle, and in a good many instances sets up a frightful vibration, and makes it most disagreeable to negotiate cobblestone roads particularly when light in the rear. The results obtained from the blank differential as compared to the regular one in this respect are most pronounced. Riding on a truck with a solid differential the load is rarely taken off both wheels at once. When one wheel leaves the ground, the full torque is absorbed in the other wheel remaining on the ground, holding the engine down and preventing racing to a very, very marked extent.

Differential Like Steamboat

The regular differential reminds one of a steamer. Every time the propeller lifts out of the water the engine races and sets up such a vibration that in a good many instances you wonder whether the ship is going to hold together or not. Imagine what a call there would be by marine constructors for something which would absolutely prevent the propeller shaft racing. This is certainly analogous to the truck situation at the present time with the exception that the motor truck can now prevent racing, with its attendant wear and tear on all the parts affected by eliminating the differential.

Every time the propeller leaves the water on a steamer and beats the air, it is just like throwing so much coal overboard. The wheel need not leave the ground actually, but the pressure can be relieved to such an extent due to oscillation of the spring over irregular road surfaces that the wheel begins to spin and the tractive effort instead of being used for the propulsion of the truck is simply using the gasoline for no purpose. This is quite pronounced on heavy vehicles where the wide track is used. One wheel is tracking on good ground all the time while the other is slipping in soft mud. There is not a single truck designer of repute who has not been in serious difficulties at some time or other under these conditions. The writer is well aware that the tractive resistance might be double, due to the condition of the road surfaces, but on top of this, the loss due to the spinning differential is certainly quite pronounced.

Under the above conditions, it is common for engineers to consider the radiator too small—the engine not large enough—or the gear reduction wrong, when in a good many instances the differential is directly responsible, operating on extremely muddy roads with a very heavy gasoline consumption at the best, and sooner or later a solid axle will be called for more extensively on account of gasoline economy, if nothing else.

Dependability Increased

With the elimination of the differential, broken gears, differential spiders freezing fast, broken cases, etc., are a thing of the past, but one has to be extremely careful with the size of drive shafts, as the stress in these members is doubled and must be amply taken care of. The particular advantage of using semi-floating axles under these extreme conditions lies in the fact that the outer ends must of necessity be made very liberal in size due to the combined bending and torsion, and it is a comparatively easy matter to increase the inner ends of the drive shafts. If this be done there is absolutely no question of broken drive shafts and the whole axle becomes thoroughly dependable.

For example, in one of our axles where we would ordinarily use a shaft 1½ in. across the flat of the hexagon end of the shaft where it fits our differential, we step this up to 1¾ in., all of which change it was possible for us to make with no other complication whatever than to increase the size of the drive shaft. It was not necessary to make any change in the center of the axle construction other than to

provide the "locked" differential with a broached hole 1¾ in. instead of 1½ in., and it was possible to do this without any change of parts whatever.

This means that a man who might have an axle in service with a conventional differential and wants to eliminate the troubles as a result of the use of a conventional differential, will simply change his drive shafts, take out his conventional differential, put in our "locked" differential and the job is finished.

Cutting out the differential ring gear and pinions with the spiders has reduced this design to its simplest possible form. Every one of these parts are going to wear with their attendant backlash. The elimination of backlash alone is almost sufficient justification for the design, but the simplicity of the construction will appeal to every one.

One of the objections at the present time to the live axle type of drive is the unsprung weight at the center of the housing. This, of course, is in the worst possible place and the more the center can be lightened the sections throughout the axle can be considerably reduced.

There is also a distinct gain in the oil capacity as compared to the full type of differential. The outside dimension of the axle housing remains the same. The space taken in the ordinary construction with gears will allow of that much more oil being carried, which is a consideration when operating under severe conditions.

Price Reduced

It is evident at a glance to the layman that there is considerable reduction in price to be made in this construction over any form of drive known at the present time, and we prophesy that this alone will give it the increased popularity it richly deserves.

Summarizing, after considering all the various points, it is well not to become too enthusiastic, as the introduction of a blank differential on the face of it is so drastic that one must of necessity move with extreme caution. The time taken in rounding a corner is only a fraction of 1 per cent of the straightaway running, and if a truck is continuously operating around a city block (eight blocks to the mile), it figures around 4 to 5 per cent of the straightaway time, but with average wheelbase and tread, and strong drive shafts, the positive pull on two wheels, greater tire mileage, less wear and tear, gasoline economy, and the extreme dependability with simplicity, weight and price in its favor, we prophesy quite a following of the blank differential.

Car Storage Batteries Are Often Too Small

By Walter LeGare

IT IS with a great deal of interest that I have been reading articles in the leading automobile publications on Magneto vs. Battery ignition, both pro and con, and while I do not lay claim to being an authority on the points involved, the article by N. J. Hart in *THE AUTOMOBILE* for March 9 compels attention, and in my modest way I beg to submit a few points along this same line.

We have to admit the present-day magneto will give a spark that is better for starting under adverse conditions than a battery system. The only talking point against the magneto is the extra initial cost, and this applies to cheap cars only; and the man who buys such a car does not expect equipment that one would get on a medium or high-priced car.

The magneto costs very little to maintain and keep in perfect condition. I estimate that the average magneto will not cost in excess of \$2 a year for repairs, while the battery alone will cost not under \$4.50 a year and in most cases \$6 to \$8 repair each year and be worthless after about two

years' service, whereas a magneto will be in prime condition after two years' service, and a few dollars will place it in excellent condition and, in fact, make it as good as new.

In my argument I am not considering the attention the two systems should have but only the attention the average owner gives his car—we all know the average car receives very poor attention.

Regarding that part of Mr. Hart's article on voltage drop, I have found that in the case of a battery which is only three-quarters charged, the actual drop is more than he states with the batteries generally used. I know of only one manufacturer, the Cadillac Motor Car Co., who uses a battery that is large enough to crank the motor and give current for ignition in excess of what is needed. The average manufacturer places a very small capacity battery on their cars; they really are large enough for ignition only and should never be used for starting.

I have made a study and specialty of battery repairing, not because the battery is better than the magneto but because I can make more money repairing batteries than I can repairing magnetos.

Another, and a main point against the battery is its inability to give off high discharge rates after it has seen about a year's service. This I attribute to the fact that the positive plates will become corroded by sulphate just like rust will cover a piece of iron or steel. This is also true of the negative plates but not so noticeable.

Do you know of a battery ignition system that uses a multi-point spark plug? Practically all magneto manufacturers recommend multi-point plugs, the reason for this being that in the battery system they have a job getting a spark across a single gap; so why should they assume the extra trouble of trying to bridge two or three gaps? This is no job for the present-day magneto.

Displacement, Gear Ratio and Consumption

By F. I. Anderson

I HAVE just read, with pleasure and profit, the comment on page 509, *THE AUTOMOBILE*, by W. P. D., on my question on page 422 on the subject, "Piston Displacement per Mile Measures Consumption."

He states that my error in figuring mileage positively from piston displacement and gear ratio, lies in assuming that one gallon of gasoline, 70 deg. Baume, gives 25 cu. ft. of gas. W. P. D. asserts that one gallon of gasoline, 61 deg. Baume, at 60 deg. Fahr., gives approximately 240 cu. ft. of vapor, or nearly ten times as much as I assume.

I took my figures for this assumption from an article on

Motor Fuels, in *Scientific American Supplement* of Dec. 11, 1915, by Prof. Vivian B. Lewes, F. I. C., F. C. S. Professor Lewes gives the following table on the volume of vapor from gasoline hydro-carbons:

| | Specific Gravity | Boiling Point | Cubic Ft. Vapor Gallon | Pound |
|---------------|------------------|---------------|---------------------------|-------|
| Pentane | 0.626 | 37.6 deg. C. | 31.2 | 4.9 |
| Hexane | 0.664 | 69 deg. C. | 27.7 | 4.1 |
| Heptane | 0.700 | 98 deg. C. | 25.7 | 3.7 |
| Octane | 0.719 | 118 deg. C. | 22.6 | 3.1 |
| Nonane | 0.741 | 136 deg. C. | 20.8 | 2.9 |

Doctors seem to disagree on this rather vital point. I sincerely hope that W. P. D., with his 240 cu. ft., is right, as the price of gas is still going up.

Which is right?

If, at high speeds of modern engines, 80 per cent of the gasoline drawn into the cylinders actually goes through raw and is wasted, then there is something radically wrong with the trend of engineering design in the last year or two.

Past the Maximum Efficiency Point

The modern motor attains its highest gas efficiency at between 1000 and 1200 r.p.m. At that speed, the ultimate proportion of the present-day low-grade gas is utilized.

Yet we find engineers working their motors up to 4000 r.p.m. Cars with such motors are on the market not as racing cars—where economy counts for little—but as boulevard cars. If, as seems to be the case, gas efficiency decreases almost in direct proportion to speed above a very modest point, what is the argument in favor of the modern high-speed motor?

The stock answer is that the American driver hates to shift gears. But behind this is the truth that the transmission on the average American car is the weakest point in the mechanism, so the engineers give the driver great ability on high; and the result is that the owner of a modern six or eight or twelve-cylinder motor never learns to shift properly at the rare times when it is necessary. Develop the archaic gearbox, instead of trying to blind us to its imperfections by the device of high engine speed. When someone comes along with an efficient transmission for moderate-priced cars, then the American driver will come back to gear-shifting, with his European brother; that will automatically solve the fuel problem, in a measure at least, by bringing us back to an engine that runs at economical speeds, instead of one that wastes 80 per cent of our gasoline in the exhaust.

A Gas-Electric Ideal

A gas-electric drive, that will govern within 5 per cent, like the modern isolated gasoline-electric light plant, will solve the problem. Then the gas engine can run at its most economical speed, and the dynamo transmission will automatically adjust itself to the load, and we won't have to carry a 100 per cent surplusage of inefficient power.

Vim Adds Model Designed for Postal Delivery Service

PHILADELPHIA, PA., April 15—The Vim Motor Truck Co., this city, has added a mail delivery car to its line of seven standard units. The new vehicle is called the model M and sells for \$800. Some time ago the Vim company received an order from the United States Government for a mail carrier to be built according to strict specifications, and the demand which sprang up for these cars resulted in the adoption of model M as a regular model. The body has full screens all around, with doors at front and rear. There is a passenger step at the back for the use of the mail carrier and other equipment is up to Government specifications. The body, which is mounted on the standard Vim four-cylinder chassis, is designed especially to meet the requirements of post offices, mail contractors, rural free delivery routes, etc.



The new model M Vim mail delivery car listing at \$800



The Rostrum

Knurling Helped Undersize Pistons

EDITOR THE AUTOMOBILE:—In making up some new aluminum alloy pistons cast in chill the machining department made the clearances a trifle too large, and as these 4-in. pistons were for special show cars and afterwards demonstrated, it was necessary that action of some kind be taken as no more castings were available immediately.

The superintendent of this plant conceived the idea of knurling these pistons and this was accordingly done with a coarse knurl running over the skirt of the piston three times and bringing the diameter of these pistons from 0.009 in. under size up to 0.003 in. under cylinder bore.

Pistons were placed in motors and run 5 hr. under full load in shop and never picked up, and when removed were in perfect condition, the depressions caused by the knurl holding oil perfectly.

You will understand that for this size piston 0.003 in. is very little clearance.

Indianapolis, Ind.

W. S. R.

Calculating Motor Cylinder Displacement

EDITOR THE AUTOMOBILE:—Kindly tell me how to find the cubic inch displacement of any motor if the bore, stroke, and number of cylinders only are given?

2—How can I tell by the r.p.m. of a motor what horsepower it will develop?

3—What are the rules and regulations for amateur racing, for the driver and the car?

New York City.

G. K.

—The rule to find the piston displacement is to follow this equation: bore \times bore \times 3.1416 \times stroke \times number of cylinders = piston displacement.

2—You cannot tell from that data.

3—Copy of the racing rules can be secured from the Contest Board of the American Automobile Assn., 437 Fifth Avenue, New York City.

Thin Mixture as Overheating Cause

EDITOR THE AUTOMOBILE:—I am a subscriber to your magazine, and I always read your columns with interest. In almost every number I pick up I see some mention by a subscriber of overheating troubles, and the old fallacy repeated that a rich mixture is what causes overheating. Now I beg to submit that it is an absolute physical impossibility to overheat an engine with a rich mixture, whereas a very thin mixture will cause a great excess of heat. If those who are having trouble could be advised to enrich their mixture instead of making it leaner, which only aggravates their condition, many overheating annoyances would disappear.

In case any reader is inclined to disagree with me, and entertains the belief that a rich mixture really does cause overheating, I should like to ask him to explain the following occurrences which have happened to me personally at various times in the past.

Once in 1907 in Boston one of my customers drove his car to my office with the complaint that the engine was missing. On investigating, I found that it was missing from a too rich

mixture and I thinned it down and he drove the car home. In the morning he telephoned me that he could not start his engine, and on going out to his house I found that I had thinned the mixture so far that the engine did not start when cranked. I corrected the difficulty and asked him if he had experienced any other trouble. He said that while driving home the night before, which was only three miles, his engine boiled for the first time since he had had the car. Here was a case where this man's mixture had been excessively rich, so rich that it missed, and yet no overheating was caused, and yet when thinned down (and not to an excessively thin point either, for it did not pop into the carburetor) it boiled for the first time since he had owned the car.

Another time in New Bedford in 1908 a man complained to me that his engine boiled continuously and he said that every mechanic in town had tried to correct the trouble by making his mixture thinner, but it only boiled the worse. In five minutes I had his carburetor adjusted correctly so that during the two days I was in New Bedford he was unable to make his motor heat, though he tried driving at top speed for many miles in the hot sun. To correct his trouble I had enriched his mixture very considerably.

Another time in 1910 in the winter I started from Pontiac for Detroit with a car which had just been overhauled. I knew that the radiator was full, for I examined all the tanks before starting, and yet, before I had gone a mile the water was boiling furiously, even though the temperature was well below freezing. I stopped the car, refilled the radiator, enriched the mixture considerably and resumed the drive, and never once did the engine heat, even though I was driving in low speed and wallowing through deep drifts of snow for the greater part of the 25 miles.

Last summer in India, while driving a six-cylinder car between Lucknow and Cawnpur, the engine overheated in the first few miles. I instructed my companion to enrich the mixture, which he did, and although I maintained a much higher speed for the rest of the distance, which is 50 miles, there was no further sign of overheating.

I could cite many other instances similar to the above, which have come under my own personal observation. Now I should like to ask you simply as a matter of logic, if it is a rich mixture that overheats the motor, how do you explain these occurrences?

Detroit, Mich.

F. R. PENDLETON.

Information on Schebler Carburetor

EDITOR THE AUTOMOBILE:—Will you kindly give a description of the Schebler carburetor used on the Studebaker four, 1916? In the instruction book it gives the reverse adjustments from those made by the sales agency's shop men. Would it be possible to use a leaner mixture if both hood and radiator were covered during cold weather, using a standard hood and radiator cover?

Philadelphia, Pa.

O. S. W.

—To adjust carburetor turn air valve cap A, Fig. 1, clockwise or to the right until it stops, then turn to the left or anticlockwise one complete turn. To start engine open throttle about one-eighth or one quarter way. When motor is started

let it run until engine is warmed, then turn air valve cap A to left or anti-clockwise until engine hits perfectly. Advance spark three-quarters way on quadrant; if engine back fires on quick acceleration turn adjustment screw F up, which increases tension on air valve spring, until acceleration is satisfactory.

Turning air valve cap A to right or clockwise lifts needle E out of gasoline nozzle and makes rich mixture for starting. As motor warms up, move control lever gradually back toward Air or Lean to obtain best running conditions until motor has reached normal temperature. When this temperature is reached, control lever should be at Air or Lean.

A Special Valve-Seating Tool

Editor THE AUTOMOBILE:—Herewith sketch, Fig. 2, of a valve-seating tool which helped us out of a rather difficult job. We could have put this job in a lathe, but it would have taken more time. The sketch represents a cage-in-head type motor and the tool with which the work was performed. In removing the cage it was found that it had been driven so tightly in the head that the motor could be raised from the chassis by lifting by the cage only, therefore in removing same the seat at point C referring to sketch was jammed so that it had to be machined smooth again. The writer used an old valve and stem as per sketch, machined it down at point D to a running fit at E, then cut it out at point F with hacksaw, used a set chisel at point A, forcing the metal down as at point B, then case-hardening same ground to a cutting edge, the edge B being about 0.010 lower than face G. The facing operation at point C in the cylinder was accomplished in about 5 min. in a 20-in. drill press, making an A-1 job in about 30 min. The 30 min. time included making the tool also.

Des Moines, Iowa.

S. E. H.

Peerless Six Developed 110-120 Hp.

Editor THE AUTOMOBILE:—What is the power curve of the 60-6 Peerless later models?

2—What is a fair speed to expect from this car in good order with touring body?

3—Has the Benz concern turned out more than one machine, termed Blitzen Benz?

4—What is the bore and stroke of the Blitzen Benz which attained speed of 147 m.p.h.? I have talked with a man who now owns a Blitzen Benz, and he claims to have driven it 157 m.p.h. He says the bore is $6\frac{1}{2}$ in., stroke 9 in. and that this car is the one that holds world's record. I understand from your magazine that cylinder dimensions were $7\frac{5}{16}$ in. by 8 in. He says this is not the car that raced the Sunbeam twelve last fall, and that the latter car was capable of only 120 m.p.h.

5—Can you give particulars as to how the Stutz works double ignition from Bosch single high-tension magneto? I understand that some such arrangement is being used by them owing to lack of Bosch double ignition magnetos.

Milton, Mass.

A. D. H.

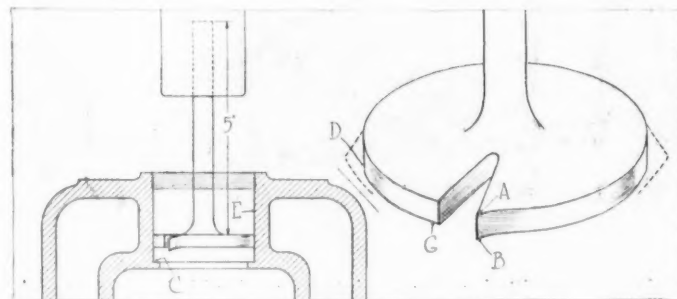


Fig. 2—Valve-seating tool developed by a subscriber and its application in a difficult job on a motor

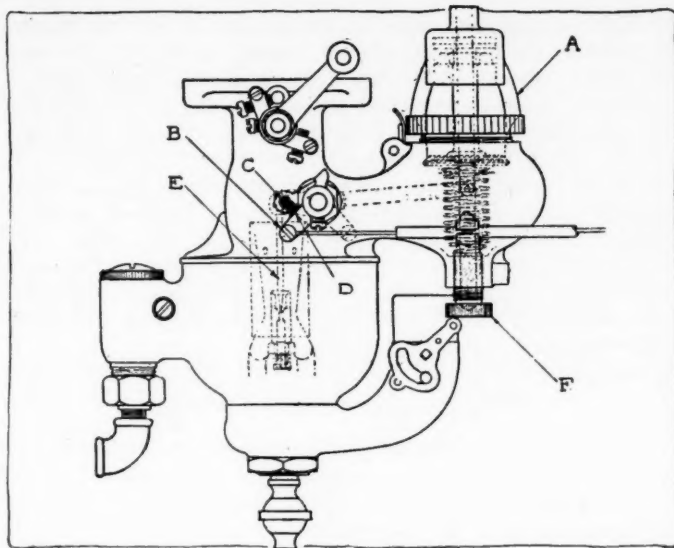


Fig. 1—Adjustment diagram of Schebler carburetor used on 1916 Studebaker four-cylinder model

—The Peerless company states that the old Peerless model 6-60 developed too much horsepower for the regular dynamometer and hence tests were carried on with a fan dynamometer to 110 or 120 hp. at 1585 r.p.m. The gear ratio on this car was 2.56 to 1 with 38-in. rear wheels.

2—Car of this model in good order should reach 70 m.p.h.

3—In all, three cars only were built of the Blitzen Benz type, the cylinder dimensions of which are 185 mm. bore and 200 mm. stroke. The world's record of one of these cars, of which two are in America, was established at Daytona Beach, Fla., April 23, 1911, by the late Bob Burman. It was the first car imported of the two here in America that was given the name Blitzen Benz, and was the record-making car.

As far as THE AUTOMOBILE has record now this car is in the hands of E. A. Moross. The other car of this type is now owned by Harry Harkness and was the second one brought to this country. It does not hold any record at the present time. The world's record for the Blitzen Benz was 1 mile in 25.40 sec.

4—Answered under No. 3.

5—This method, while not recommended by the Stutz company, has been used by some of the Stutz owners on account of not being able to secure the two-spark instrument. The method you speak of and which these users have employed is to connect two sets of spark plugs with the single ignition magneto. These might be series plugs or some other adaptation which renders this possible.

Explanation of Engine Cycle

Editor THE AUTOMOBILE:—Please explain the meaning of the word cycle, and its functions in a gasoline motor. Is each stroke a cycle, etc.?

2—Explain the firing and timing of eight- and twelve-cylinder motors.

3—Had the Marmon 32 a four-cylinder motor?

Dunn, N. C.

K. F. H.

—The word cycle refers to a complete set of operations bringing the engine back to the point referred to at the beginning. We say the words four cycle, meaning it takes four strokes to complete a cycle of events in the cylinder. The correct manner of expressing this would be four-stroke cycle as each one of the strokes is only the mechanical action necessary in carrying out the cycle of intake, explosion, expansion and exhaust.

2—The timing and firing of all multi-cylinder engines is arranged to accommodate the angles at which the different cranks are set to each other. This must be done in order

that the engine will balance. Regardless of how the engine is timed or the firing order each cylinder carries out its independent action as if it were a single-cylinder motor and it does not depend on any other cylinder to assist it in carrying out its cycle. The firing order naturally depends altogether on the valve timing of each cylinder since it is only a matter of exploding the charge which is compressed in the proper cylinder. The firing orders of eights are the same as fours since the action of the eight is just exactly the same as if there were two four-cylinder engines operating on the same crankshaft, which is exactly what holds true mechanically. The same relationship holds true between twelves and sixes.

3—Yes.

Mixing Gasolene and Kerosene

Editor THE AUTOMOBILE:—What is the real objection to mixing gasoline and kerosene as a fuel for motor cars? Of course, I have heard of such use of it now and then but why is it not generally so used especially since the price of gasoline has advanced so rapidly. I have a Chalmers six-cylinder and would you suppose that such a mixture as half and half would work satisfactorily?

Somerville, Mass.

C. E. I.

—As a matter of fact unless you are quite fortunate you are using a mixture of kerosene and gasoline as a matter of practice in your car. It is one of the methods used to dispose of the great surplus quantities of kerosene now on hand. The action of the mixture is just what may be expected from a heavy grade of fuel. A mixture of half-and-half in your Chalmers would probably work quite well after the engine had once become warm.

Distributor vs. Magneto Ignition

Editor THE AUTOMOBILE:—What are the advantages of the distributor ignition system over the high tension magneto and also the advantages of the high tension magneto over the distributor ignition system?

2—What is the factory rating of the 1916 Hupmobile?

Niagara Falls, N. Y.

P. N. P.

—In answer to your first question, would refer you to the following papers read at the winter meeting of the Society of Automobile Engineers and reported in THE AUTOMOBILE for Jan. 13:

Magneto vs. Battery Ignition by Francis R. Hoyt.

Notes on Battery Ignition by Alex. Churchward.

Battery vs. Magneto Ignition by Frank Conrad.

These give all sides of the battery-magneto question.

2—The brake horsepower of the model N Hupmobile runs

as follows: 10 hp. at 400 r.p.m. and 36 hp. at 1700 r.p.m., which is the speed of maximum horsepower. These motors are purposely timed to give maximum horsepower at the speed mentioned.

Vacuum Feed Feasible for Ford

Editor THE AUTOMOBILE:—I have been much interested in your various articles about the advantages of rear tank and vacuum feed.

Would it be feasible or sensible to put this system on a Ford? If so, how can it be done in the simplest manner?

New York City.

F. H. H.

—The Stewart vacuum feed can be readily installed on the Ford car, and in fact the Stewart company issues with the vacuum system a book giving directions how this should be done on different models. The method of installing on the Ford sedan is different from that on the Ford touring car but general directions apply. There are three simple things to remember; first, the top of the Stewart vacuum tank must be above the level of gasoline in the main supply reservoir when full, even when car is going down steep grades. Second, the bottom of the vacuum tank must be not less than 3 in. above the carbureter; and third, the Stewart vacuum tank must not be installed over the generator nor above any electrical terminals on which gasoline could possibly leak.

Amateur Wants Race Information

Editor THE AUTOMOBILE:—What does one have to do to enter a twenty-four-hour automobile race? I have never been in a race before.

2—What is the meaning of a stock car race?

3—How old a car may be used?

4—There is to be a twenty-four-hour race some time this year at the Bay track. Where can I find out full particulars and rules in reference to such a race?

Brooklyn, N. Y.

MODERN GARAGE.

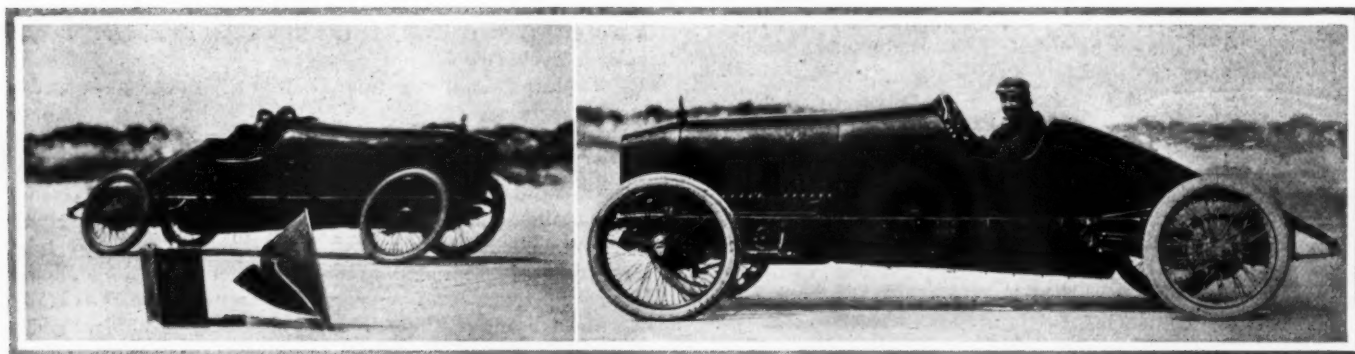
—The qualifications necessary to enter the race is simply that the driver is registered with the American Automobile Assn. and is satisfactory to the A. A. A. officials in charge of that race.

2—A stock car race is one in which the contesting cars have the same specifications as the cars sold by that concern in the open market.

3—The age of the car is immaterial.

4—Full details of all sanctioned events can be secured from the American Automobile Assn., 437 Fifth Avenue, New York City.

The Record-Breaking Hudson Super Six on Ormond-Daytona Beach



Hudson stock Super Six chassis on Ormond-Daytona beach. At the left the car is illustrated traveling at 102.5 m.p.h. and at the right after the tests were completed. On the stock chassis was mounted a special racing type body, the steering

column was tilted and a radiator guard added. The chassis was geared 2 11/18 to 1. Valve timing was stock and cast-iron pistons were used. A. A. A. officials checking all specifications for stock classification.

ACCESSORIES

Sunderman Mouse Trap Carbureter

SIMPLE in construction and in adjustment, this carbureter is claimed to feed pure combustible gas from cold kerosene or gasoline to the motor without changing the adjustment, no hot air or water jacket being needed. As shown in the illustration, the rectangular float chamber *F*, fitted with a primer, is adjacent to the mixing chamber, which is simply a square passage. The fuel is admitted to this passage through the jet *J1* for low speeds and when idling and when the speed is increased the taller jet *J* automatically comes into play so that both jets are operating at once.

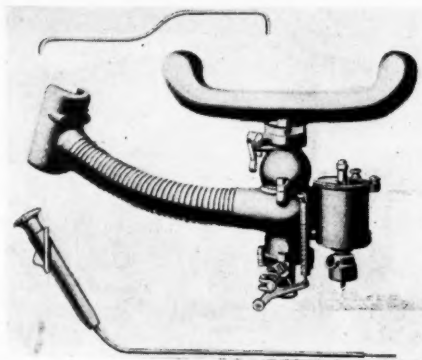
Air is drawn through the valve *V*, which is regulated by the tension on the spring controlled by the adjusting collar *A*. In the illustration the air intake door is shown in the position it assumes when the motor is idling and fuel is being fed through the short jet *J1* only. As the air rushes into the vacuum behind the intake door it sweeps the globules of fuel from the jets and the resulting vapor is further disintegrated into a homogeneous mixture by passing through the screen *S*, after which it passes the throttle *T* on its way through the manifold to the combustion chamber.

Besides an unusually high degree of fuel economy, the makers claim the carbureter gives great flexibility with consequent minimized gear shifting. The screen *S* prevents backfiring with its attendant dangers, and the elimination of a gasoline adjustment by the use of the regulating jets renders adjustment extremely simple. In fact, the makers state that when the carbureter is once set correctly, further changes will be unnecessary.

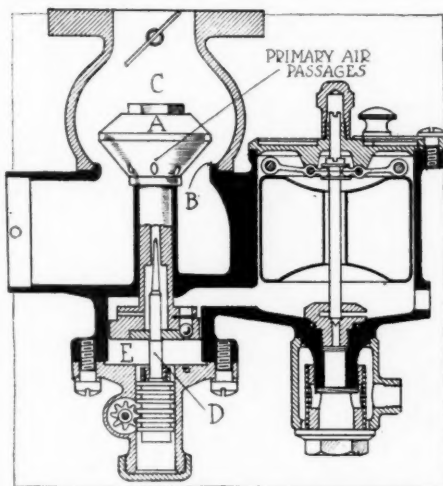
The carbureter is made in brass, iron or aluminum alloy, in $\frac{3}{4}$ in., 1 in., $1\frac{1}{4}$ in. and $1\frac{1}{2}$ in. sizes, under the names of models A, B, F and C, respectively, and as the model Twin F for eight or twelve-cylinder cars. Model F weighs $1\frac{1}{4}$ lb. in brass or iron and 10 oz. in aluminum alloy, and is $4\frac{1}{2}$ by $2\frac{1}{2}$ by $1\frac{3}{8}$ in.—Sunderman Corp., Newburgh, N. Y., maker. J. F. Renfro, Co., Inc., New York City, sole factory distributor.

Fracto Anti-Glare

In this device half of the frustrum of a cone, formed of glass with specially shaped surfaces, is placed in the lamp under the bulb. The effect of the device is to project all the rays downward when the lamp is first adjusted so that the rays from the top are projected down-



Stewart carburetor for Fords, with manifold



Section through new Stewart carburetor



Fracto anti-glare lens



Culver-Stearns windshield searchlight

ward before the attachment is put in place. Two points of adjustment are available, one for a diffused short-distance light and the other for projection. No dimming device is employed, the principle employed being the proper collection and distribution of all the light-rays thrown out by the bulb. The device sells for \$2.75 per pair.—Fracto Specialty Co., Boston, Mass.

Culver-Stearns Searchlight

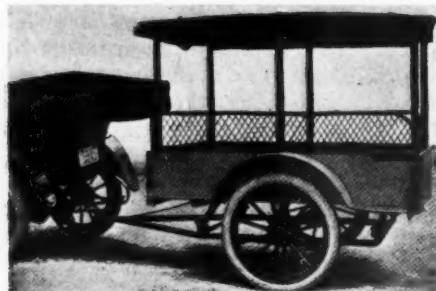
This searchlight is of the windshield type, adjustable so that it can be turned in any direction for sign-reading and so forth. Though only 3 in. in diameter it throws a powerful beam of light, having an 8-cp. helical coil tungsten bulb; the makers state that signs can be read at a distance of 200 ft., a focusing device permitting exact adjustment. A switch built into the lamp eliminates the necessity for an extra switch on the dash. The bracket is substantial and clips to the edge of any type of windshield. Price, \$2.25—Culver-Stearns Mfg. Co., Worcester, Mass.

Victor Spot Lamps

Made for windshield and foredoor attachment, the Victor spot lamp is equipped with 21-candlepower nitrogen bulb lamps. It can be secured to either of these two parts of the car by means of a bracket with a universal joint that allows the beam of light to be instantly turned in any direction. The swivel joint is of such construction that the friction maintains the position of the light but with sufficient flexibility that it may be easily moved in any direction by means of a handle at the back of the lamp. By the use of this lamp, side roads and passages may be inspected before turning the car and serious accidents thus avoided. The reflector is not a true parabola, but is a special shape which not only throws the parallel beam for a long distance, but also illuminates a wide field. The lamps are valuable in localities where brilliant headlights are prohibited. The price of the lamps of $6\frac{1}{2}$ -in. diameter is \$7.50.—Victor Auto Parts Co., Cincinnati, Ohio.

Alcohol Solution Tester

Balls of various specific gravities, corresponding with the specific gravities of alcohol-water solutions for different freezing points, constitute this device. For a given solution a test is made, using the proper ball, by drawing off a small quantity of the solution from the radiator dropping the ball into it, and allowing it to remain for a minute, which is long enough to equalize the temperatures. If the ball floats more alcohol is needed; if the ball sinks there is enough. The makers state that the balls contract and expand with temperature changes at the same rate as the solutions in which they are used, so that no



Curtis 1000-lb. canopy top trailer

allowance has to be made. For a quick test the ball may be dropped into the radiator through the cap. Price, 25 cents each.—Liquid Tester Co., Lancaster, Ohio.

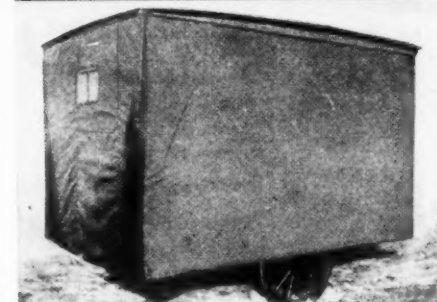
Curtis Trailers

The outing trailer is to provide a comfortable portable home to be drawn behind a car. The trailer carries what is in reality a little house with windows and doors in the ends. At the sides are two bunks, which form parts of the side walls when not in use. At night these are let down outwardly and canvas side walls are let down over them, making a snug little room with two beds in it. A fly is provided on each side also. The beds consist of Way sagless springs, 4 by 6 ft., 2 in. and felt mattresses; khaki covers are provided so that the beds when made up can be folded without becoming disarranged. An ice chest and a small oil stove also are furnished. Four adults can sleep on the beds, and for extra persons folding cots can be carried and set up at night under the bunks, which are 3½ ft. from the ground. A ball-and-socket coupling is provided for the attachment of the trailer to the rear of the car. Weight of trailer alone, 500 lb.; equipped for the road, 700 to 750 lb. Price, \$250.

The capacity of the Curtis two-wheeled trailer is 1000 lb. The lower priced types have box or stake bodies and steel-tired wheels; more styles are built up to the special model with canopy top and side curtains, wire sides, pneumatic tires and other refinements. A special model is supplied for cradling a canoe or small rowboat. The maker lays stress on the coupling used, which allows for adjustment in all necessary directions and keeps the trailer in its proper place regardless of road conditions. Prices, \$47.50 to \$137.50.—Curtis Trailer Co., Minneapolis, Minn.

Simplex Jacks

The Simplex variable lift jack is of the lever and rack type, and the construction is substantial; its advantage, however, is that on the outer face of the lifting column there are steps on which a lifting foot can be adjusted, giving seven different heights in addition to that of the head. The jack is of heavy malleable



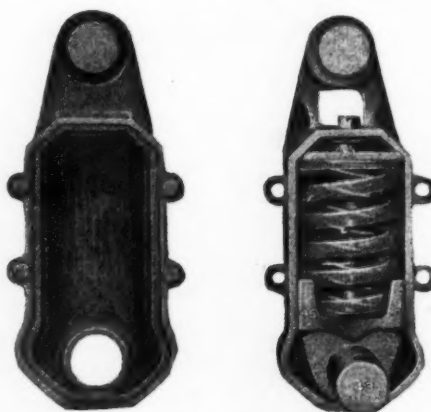
Curtis outing trailer, open for camping and closed for towing by car



Simplex jack with adjustable foot



Simplex jack with three-position head



Savidge spring steering device

iron and the column is of I-beam section. Lifting capacity, 1500 lb.; height closed, 10½ in.; lift, 6 in.; weight boxed, 9 lb.

The geared jack has a detachable shoe at the head, which is shown in three positions; two of the positions give less than normal height and the third gives more than normal height. When the plain head is to be used the shoe is slipped out of place. The operating pawls on the lever end act on a gear meshing with the rack cut in the lifting column. All working parts are of steel; capacity, 4000 lb.; lift, 8½ in.; available lifting heights, 9, 10½, 11¾ and 13 in.; weight, with steel lever, boxed, 13 lb.—Templeton, Kenly & Co., Chicago, Ill.

Savidge Steering Device

Considerable improvement has been effected in this steering device for Ford cars since it first was put on the market. The principle remains the same, however. A helical spring is carried in a casing which projects backward from the front axle, to which it is bolted; its inner end bears against a stationary cam and the outer end of the casing is attached to the cross-rod of the steering gear. When the cross rod moves in deflecting the steering wheels the casing carrying the spring is moved to one side or the other, and the spring, moving against the stationary cam, is compressed and tends to bring the front wheels back to the straight-ahead position. The object is to take the wobble out of the wheels and to prevent their being turned with dangerous suddenness and sharpness; it also takes up lost motion and absorbs shocks. Attachment is easily effected without machine work or drilling. Price, \$4.90.—Meixell Co., Indianapolis, Ind.

Marvel-Mist Sprayer

The Marvel-Mist cleaning and polishing compound may be used in a sprayer, a light coating being sprayed on the car body and rubbed off with clean cheese-cloth. The makers state that it prevents the paint from deteriorating, softens mud and removes oil, grease and road tar and that it produces a high polish on the surface that will not catch dust. A small outfit with cloth sells for \$1 while a large one is \$1.25. A pint can for refilling the sprayer is listed at 75 cents and the quart size \$1, ½ gal. \$1.75, 1 gal. \$2.75 and 5 gal. garage outfit \$12.50.—Marvel-Mist Mfg. Co., Brooklyn, N. Y.

Simon's Dim-A-Glare

Dim-A-Glare is a paste that is applied to the glass, and once it is put on cannot be rubbed or scraped off, it is said. Either the whole or part of the glass will be treated. It sells for 25 cents per tube.—Simons Mfg. Co., Vallejo, Cal.



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The Automobile is a consolidation of The Automobile (monthly) and the Motor Review (weekly), May, 1902, Dealer and Repairman (monthly), October, 1903, and the Automobile Magazine (monthly), July, 1907.

Accuracy in Design

ON page 711 in this issue of THE AUTOMOBILE attention is drawn to the need for taking proper precautions when adopting Hotchkiss drive. Hotchkiss drive, especially when used for trucks, may easily disturb the brake layout and the article is prompted by the discovery that several engineers have overlooked this fact altogether. The efficiency of an automobile and of a motor truck, as it is gaged by the owner, is made up of multifarious detail. The best machine in the world will not be appreciated if it has just one really weak spot.

It is by overlooking simple things like the relative motions of axles and brake connections that can make all the difference between an entirely excellent vehicle and one that is merely passable; reputations are built up upon care for the minutest details.

This particular case of Hotchkiss drive and brake connections is especially noteworthy, because there are many engineers who believe that Hotchkiss drive is the correct principle, and if users of trucks find that they are having trouble with brakes they will not stop to reason out why this is. If a man has used trucks with radius rods on which the brakes needed adjustment once a month and finds that a Hotchkiss drive truck needs adjustment once a week he is liable to blame the drive without further thought as to the why and wherefore.

Half an hour on the drafting board may easily save \$10,000 worth of sales with details of this kind. Let it always be remembered that adjustment of anything is always noticed if required with frequency, and every adjustment made to a car or truck is reckoned against it by the user.

Designers are often prone to lay out the car in an unloaded condition instead of taking into consideration the position of the driving members and suspension units when under normal conditions of load. The various radii of action caused by oscillation of spring members should be carefully watched especially as regards longitudinal members such as brake connections.

The Constant-Pressure Cycle

A QUESTION which is beginning to make itself heard amidst the clamor caused by high-priced fuel, high-speed engines and multi-cylinders, is that of the possibility of cycles other than the Otto. The constant temperature cycle seems to be rejected with but little consideration, while that of constant pressure is affording considerable food for thought.

So far the constant pressure engine, or variations of it such as the Diesel, has been limited to larger units. Is this because the subject has never been vigorously attacked by automobile engineers but only by those who are more used to larger plants? It opens up an avenue of speculation which may or may not lead to a revision of many existing ideas as regards engine design.

It seems that the entire difficulty centers around the use of parts which will be light and at the same time able to sustain the high pressures necessary to admit burning fuel against compression pressures much higher than those possible in Otto cycle motors. With the high compressions the air alone must be compressed and the fuel admitted at the time of combustion and admitted successive in small quantities which will give the series of lesser impulses due to burning as compared to the single violent shock of explosion.

Low Thermal Efficiency

Mean effective pressures will have to be kept high by a maintenance of high pressure throughout the burning period, even though the theoretically constant pressure may not exactly be reached. In the Otto cycle mean effective pressure depends on having the maximum pressure as close to the beginning of the explosion stroke as possible and with the small throttle opening used in touring at speeds of 15 to 20 m.p.h., these pressures fall off more rapidly than the resulting decrease in fuel justifies. In other words, very low thermal efficiency results.

If the constant-pressure engine can be developed to give high efficiency at reduced throttle or at lower car speeds, something will have been accomplished that will be of the utmost value in the event of expensive fuels. The whole series of questions left open by the industry's pioneers may again present themselves to our engineers for solution in the light of latter-day developments.

400 Attend Detroit S. A. E. Meeting— Hear Papers by Vincent and Smith

Motors of the Air and Interpreting the Public to the
Engineer Are Subjects of Two Papers of Wide Interest
—Section Closes Record Year—New Officers Elected

DETROIT, MICH., April 17—To-night's regular monthly meeting of the Detroit section of the Society of Automobile Engineers was attended by about 400 members of the section and guests, who listened to two clever talks by men in widely varying fields of the automobile industry. J. G. Vincent, vice-president of engineering, Packard Motor Car Co., spoke on Motors of the Air, and Paul Smith, sales head, Chalmers Motor Co., dealt with the subject of Interpreting the Public to the Engineer.

This session marked the closing of the most successful year in the history of the local section, and the new officers who were elected for the ensuing twelve months are D. McCall White, chief engineer, Cadillac Motor Car Co., chairman; O. E. Hunt, assistant chief engineer, Packard Motor Car Co., vice-chairman; W. C. Rands, general manager, Rands Mfg. Co., treasurer; B. G. Koether, general sales manager, Hyatt Roller Bearing Co., secretary; and K. W. Zimmerschied, chief metallurgist, General Motors Co., member of the national nominating committee.

The treasurer's report for the fiscal year just closed shows a cash balance of \$1,496.53, as compared with \$409.11 at the end of the previous year. Membership has now exceeded the 500 mark, and in every way the section's future seems very rosy. Retiring Chairman G. W. Dunham made an appeal for a permanent home for the section, and W. H. Conant, the present secretary reviewed the progress of the year and indicated the surprising growth of the section.

Motors of the Air

Mr. Vincent showed from his talk that he has been a close student of aeroplane development since the war started, and indicated how general interest has been aroused in aeronautics due to the striking service and reliability of the aircraft in the war.

In designing their war plane engines the Germans put it up to their automobile engineers, with the result that the German machines were developed with high efficiency engines built along automobile lines, the Mercedes type being the best example. The parts are light and reliable.

In France the matter was left to the aircraft engineers, and it is therefore natural that there should be various types of French designs with the strongest tendency toward the rotary-cylinder,

air-cooled type. These have great power per pound of weight, but they have proved less desirable for long flights, for when enough oil and gasoline are carried to allow them to run for long periods, the machines become heavier than the light types of automobile motors. Hence the French soon saw the advantage of the automobile type engine with fixed cylinders and developed such.

Of course, the type of fixed cylinder engine depends upon the work required. The six-cylinder is good for moderate-sized machines, but as the planes are increased in dimensions and more is asked of them in the way of carrying ammunition and passengers, the cry is steadily for more power. This has caused the development of the twelve-cylinder, V-type, as well as the eight. There is also a movement for eighteen-cylinder engines, the cylinders arranged in three sets of six around the shaft. This arrangement, however, results in too wide an engine and also makes very complicated connecting-rod lower end construction. The eight has the same objection of being too wide, since the aim is to make the wind-resisting area as little as possible. The twelve, therefore, seems to be the best answer, according to Mr. Vincent, who said further that for large planes nothing less than twelve cylinders will endure.

Another important consideration upon which Mr. Vincent touched is the matter of propeller drive—whether it should be connected directly to the crankshaft or geared down. If it is directly connected, the minimum speed has to be 1400 r.p.m., which is high. It is best to drive it as low as 900 r.p.m. sometimes, with the average speed 1200. Due to inequalities of the air through which the propeller passes, and unevenness of the weight of the wood of the blades, heavy strains are imposed upon the shaft and its mountings, and these have to be allowed for.

The Packard engineer also favors overhead valves with overhead camshafts, since the shafts in this position allow a clear mounting for the carbureters and exhaust pipes. The carbureters logically go in the V and the exhausts on the outside, this arrangement also permitting the placing of the spark plugs on the inside of the V, so that oil will drip off them, and they will be away from the hot exhaust pipes, preventing pre-ignition.

Straight cylinders seem best, and cast-iron types can be made light, reliable

and cheap, although aluminum with cast-iron liners are very advantageous. Undoubtedly, Vincent said, steel cylinders are the best possible construction, although they are expensive and hard to make by Americans. The Mercedes utilizes steel cylinders. Everything considered, the aluminum cylinder will probably dominate due to its weight.

Interpreting the Public

Mr. Smith believes that the engineers should be busier refining the essentials of the cars they already have than to be springing new things constantly. It is easier to sell what the public wants than to have to push something by dint of expensive advertising and strenuous sales methods—something about which little is generally known.

The three essentials to-day are more conveniences, better looks and more accessories.

He commended the firm that builds up samples of what it believes it will turn out for the season and then ships samples to widely separated dealers and distributors for their criticism and suggestions even before it is released to the production department.

The following shows Mr. Smith's idea of the relative importance of the five most important factors in the various price divisions. These are given in the order of their importance.

| \$2,500 and up—Motor types—6, 8 and 12 | |
|--|-------------|
| Reliability | Performance |
| Appearance | Economy |
| Price | |
| \$1,750 to \$2,500—Motor types—6 and 8 | |
| Reliability | Economy |
| Appearance | Price |
| Performance | |
| \$1,250 to \$1,750—Motor types—6 and 8 | |
| Reliability | Economy |
| Appearance | Price |
| Performance | |
| \$850 to \$1,250—Motor types—6 | |
| Reliability | Economy |
| Appearance | Price |
| Performance | |
| \$350 to \$850—Motor type—4 | |
| Reliability | Economy |
| Appearance | Price |
| Performance | |

Cincinnati Lamp Concerns Merge—Capital \$2,000,000

CINCINNATI, OHIO, April 14—The Corcoran Lamp Co., the Victor Lamp Co., and the Victor Auto Parts Co., all of this city, representing the Corcoran interests, have been purchased by a local syndicate. The consolidation plan is for a \$2,000,000 corporation with \$1,500,000 of common stock and \$500,000 of preferred stock. The common is to be offered at 70 and the preferred at par.

Present indications are the withdrawal of the Corcoran family from all connection with the company. T. J. Corcoran owns the Corcoran Lamp Co.; W. J. and E. B. Corcoran own the Victor Lamp Co., and J. L. and H. R. Corcoran own the Victor Auto Parts Co.

Martine Resolution Completed

Senate Adopts Preamble to Resolution Calling for Gasoline Trust Probe

WASHINGTON, D. C., April 17—Another step in the gasoline probe was the adoption to-day by the Senate of a preamble to the resolution by Senator Martine, directing the attorney general to investigate and report whether any law is being violated by the present situation in the oil and gasoline industry. The adoption of the preamble completes action on the resolution. The preamble attacks the Standard Oil Co. This action was taken after brief debate in which Senator Martine announced the aggravated conditions in the gasoline industry.

Ohio Standard Oil May Declare 100 Per Cent Stock Dividend

NEW YORK CITY, April 18—The Standard Oil Co. of Ohio probably will declare a stock dividend of 100 per cent. There will be a special meeting May 25 to vote on a proposal which will increase the stock from \$3,500,000 to \$7,000,000. If the plan goes through this will be the seventeenth distribution of stock among the former subsidiaries of the Standard Oil Co. of New Jersey since the company was separated into its parts. Cash dividends paid during the first quarter of this year have been the largest of any quarter since the dissolution of the Standard Oil Co., except the initial quarter of 1913.

Four Sizes of Hall Trucks

DETROIT, MICH., April 17—The Lewis-Hall Iron Works is now producing four models of commercial vehicles as follows: Two-ton, worm-drive chassis, \$2,000; 3½-ton, double side chain chassis, \$2,800; 3½-ton, worm-drive chassis, \$2,800; 5-ton double side chain chassis, \$3,400. The company has appointed Kuehn & Metz, 1926 Broadway, its New York representative, and plans to locate distributing agencies on the Pacific Coast.

Four Cylinders Subject of Joint Meeting

NEW YORK CITY, April 19—A joint meeting of the Metropolitan Sections of the Society of Automobile Engineers and the American Society of Mechanical Engineers will be held in the auditorium of the Engineering Societies Building, April 20. The subject of the meeting will be four-cylinder engines and papers have been prepared by F. E. Watts, chief engineer of the Hupp Motor Car Co., and F. R. Porter, president of the Finley Robertson Porter Co., and formerly chief

engineer of the Mercer Motor Car Co.

Over 6500 invitations have been sent out to this meeting, to members of the above organizations and to the Institute of Electrical Engineers and the Aeronautical Society. The meeting will be preceded by an informal dinner.

Continental Motor Co. to Issue \$1,000,000 Notes

DETROIT, MICH., April 14.—The Continental Motor Co. is to issue \$1,000,000 in 5 per cent notes to be retired in five years. The money is to be used in connection with further enlarging the plant and also for the further financing of the concern for the next few years.

246 Reservations for S. A. E. Trip

DETROIT, MICH., April 15—Two hundred and forty-six reservations for the 1916 summer cruise of the Society of Automobile Engineers have been made on Ss. Noronic, which carries the party from Detroit, June 12, on its four-day trip. At the present rate at which reservations are being made the capacity of the boat will be well taxed by May 1, the date on which the first allotment of staterooms will be made.

Those who have signified their willingness to date to present papers and their subjects are:

C. F. Kettering, Dayton Engineering Laboratories Co.—Future Scientific Development of the Automobile.

H. L. Horning, Waukesha Motor Co.—Motors for Trucks and Tractors.

Arthur B. Brown, designer of Brown carbureter, and Herbert Chase, A. C. A. chief engineer—Constant Pressure Internal Combustion Engines.

W. R. McCulla, Packard Motor Car Co.—Mechanical Transport Under War Conditions.

Howard Coffin, Hudson Motor Car Co. and member of Naval Consulting Board—Preparedness.

J. E. Hale, Goodyear Tire & Rubber Co.—Straight-Side vs. Clincher Type Tires.

C. H. Eason, Hyatt Roller Bearing Co.—Engines for Farm Tractors.

H. D. Church, Packard Motor Car Co.—Motor Trucks.

E. A. Nelson, mechanical engineer—Pressed Steel Construction in Automobiles.

Maxwell Sends Longwell to Orient

DETROIT, April 13—The Maxwell Motor Co. is sending W. T. Longwell, its special representative, on an extended business investigation trip to the Orient. Leaving this country April 22, Mr. Longwell will visit Japan, China, Java, Sumatra, India and Ceylon. If the war should end by next February, Mr. Longwell will then continue his investigation through Egypt and then through Europe, expecting to return to Detroit in April, 1917.

Newlin Maxwell Supervisor

DETROIT, MICH., April 17—Howard Newlin, former traffic manager of the Pennsylvania Steel Co., has been appointed supervisor of traffic and transportation for the Maxwell Motor Co. here.

Industry To Aid War College

Railroad Officials and Automobile Men Study Transportation Preparedness

WASHINGTON, D. C., April 17—Military preparedness received a decided impetus to-day when an important conference between representatives of the automobile industry and railroad interests and members of the War College division of the Chief of Staff of the army took place at the War College. The conference, which was of a preliminary character and which was not open to the public, will be followed by meetings of a like nature during the next few months. Alfred Reeves, general manager of the National Automobile Chamber of Commerce, is reported to have informed the army officers of the work that has already been started in the way of compiling information as to the number of privately owned motor trucks throughout the country. Coker F. Clarkson, general manager of the Society of Automobile Engineers, and Russell Huff also are reported to have given the army officers valuable information that will be of aid in working out the transportation problem in case of emergencies.

Others who participated in the conference were Howard Coffin, S. D. Waldron, Henry Souther, George C. Diehl, A. G. Batchelder, S. A. Miles, John M. Wilson, B. Sweet, Fairfax Harrison, president Southern Railway, W. G. Beseler, president Jersey Central Railroad, and R. H. Aishton, vice-president, Chicago & Northwestern.

The conference was presided over by General Macomb and the other army officers present were Colonel Treat, Colonel Kennedy, Lieutenant-Colonel Johnston, Lieutenant-Colonel Cameron, Lieutenant-Colonel Martin, Major Jones, Major Connor, Major Lochridge, Major Moses, Major Pierce, Major Van Deman, Major Palmer, Captain Kerth and Lieutenant-Colonel Howell.

171,977 New York Registrations

ALBANY, N. Y., April 15—Registrations in this State to date amount to 171,977, as compared with 142,576 last year. Receipts amounted to \$1,477,363, as against \$1,194,439 last year. In the New York City zone this year's registration is running more than 18,000 over the first two and a half months of 1915.

Krake Studebaker Div. Traffic Mgr.

DETROIT, MICH., April 17—H. G. Krake, who was manager of the traffic bureau of the St. Joseph, Mo., Commercial Club, has become division traffic manager for the Studebaker Corp.

New Mitchell Cars Are Longer

Wheelbase Increased 2 In.—
Passenger Space Increased
—Prices \$75 Higher

RACINE, WIS., April 15—Announcements have been made of the new Mitchell line and show that for next season a considerably refined car as compared to the Six of Sixteen will be put on the market. Mechanically, the only changes are increase in the dimensions of parts made necessary by a 2-in. increase in wheelbase to 127 in.

Accessibility Is Improved

The principal refinements are in the nature of increased passenger space and a beautified exterior appearance. Along with these improvements there has been a price increase of \$75, making the five- and three-passenger cars \$1,325 and the seven-passenger \$1,360. The five-passenger touring car and the seven are exact in every particular except for the disappearing auxiliary seats which may be added to the five at any time at an additional cost of \$35.

The mechanical changes have increased accessibility in some degree. The single-unit starting system which was used on the former model has been replaced by Westinghouse two-unit operating through a Bendix gear for the starting motor and eliminating the silent chain which was a part of the starter generator drive. The engine-driven tire pump has been raised to a more accessible position and is now mounted immediately behind the fan and driven by a gear from the fanshaft. The motor design has been changed but little although the cylinder casting has been altered to allow the waterjacket space to extend further down the side, giving a greater reserve of waterjacket area.

Underslung Springs Continued

Now that the wheelbase has been increased 2 in. it has a total of 127 and this has been met by lengthening the cantilever springs 2 in. The number of leaves in the springs has also been increased and the underslung mounting maintained. The principal specifications include a 3½ by 5 motor of L-head design with the cylinders cast in a single block and in unit with the crankcase. The gearbox provides three speeds and the equipment is unusually complete. An example of this is in the glove compartment in the instrument board and the tonneau light in the back of the forward seat.

Borderland Tire Mfg. Co. Formed

LAS CRUCES, N. M., April 13—The Borderland Tire Mfg. Co. has been

formed in this city to manufacture automobile tires and tubes. Its capital is \$150,000. The officers are as follows: President, W. B. Mandeville of the Union Bank; vice-president and manager, J. T. Ward of Denver; secretary, J. O. Miller of the First National Bank; treasurer, F. W. Campbell of the Bowman Bank and Trust Co. The directors are G. H. Totten, J. T. Ward, J. L. Burnside, Gustave Manasse, J. O. Miller, W. B. Mandeville and F. W. Campbell.

Winton Prices Raised \$200

CLEVELAND, OHIO, April 15—The Winton Co., this city, will on May 1 raise the price on the 33 Winton Six \$200. The increase, which is 8¼ per cent, will bring the prices up to the following:

| | |
|--------------------------|---------|
| Five-passenger touring | \$2,485 |
| Seven-passenger touring | 2,535 |
| Six-passenger touring | 2,635 |
| Four-passenger touring | 2,485 |
| Roadster | 2,485 |
| Sedan | 3,700 |
| Limousine three-quarters | 3,450 |
| Limousine, fore-door | 3,700 |
| Limousine-landaulet | 3,700 |
| Coupe | 3,400 |
| Coupelet | 2,800 |
| Chassis only | 2,200 |

McFarlan Increases Prices \$210—To Discontinue Series T

CONNEERSVILLE, IND., April 16—The McFarlan Motor Co., this city, will discontinue the manufacture of the series T roadster and touring car, selling at \$2,830 and \$2,680. On and after May 1, the McFarlan touring car will be built in series X only. All models under this series will be increased in price \$210. The touring car will sell at \$3,200 as will the roadster. The sedan will receive the same increase in price and will sell at \$4,210. Two limousines, one a seven-passenger, and the other a six-passenger, will sell at \$4,410 and \$4,210, respectively. A seven-passenger berline has also received this \$210 increase, and will sell at \$4,510.

Canadian Chalmers Price Unchanged

WINDSOR, ONT., April 15—For the present the price of the Chalmers Six-30 will not be changed in Canada and will remain \$1,475 for the touring car and roadster and \$1,090 for the cabriolet, duty paid f.o.b. Windsor. This cancels this company's former announcement of the price increase on the Six-30 as affecting Canada. Through its foresight in establishing itself in Canada this company is able at least for the time being to sell cars in Canada without increasing the price. This is in line with the recent decision of the Chalmers company to build Chalmers cars in Canada and is one of the first advantages offered Canadian motorists because of this plan. The price of the Chalmers Six-40 remains at \$1,950 f.o.b. Windsor.

Will Manufacture Ben Hur

Racers To Be Stock Chassis of
Series for Sale on Regular
Market

CHICAGO, ILL., April 15—The Ben Hur cars which are being built to represent the Chicago speedway during the 1916 racing season, will be the first models of a series which will be produced for the regular market. While of course they cannot be advertised as such, it is stated that these cars will be stock models so far as the chassis and engine are concerned; that is, the regular production of the factory will be the same in design and manufacture as the cars which will make their debut on the tracks this summer.

David F. Reed, president of the Speedway park association, while admitting that leading members of the association were interested in backing a team of racing cars to represent Chicago, states that these cars will not be owned by the Speedway park association proper or campaigned by them. It has been decided to campaign the team under the title of the Ben Hur Racing Assn. which is organized under the charter as not for profit. No dividends will be declared; the initial capital being subscribed by fifty or 100 members of the Speedway park association.

Any returns in the form of prize money, etc., accruing to the Ben Hur racing association will remain in the treasury of the association for the purpose only of research work and development of motors and cars.

According to Mr. Reed, the Ben Hur racing association will not build a special or individual motor for the sake of winning a prize or for commercial publicity, but any motor used in any one of its racing cars must be identical with that offered in the standard passenger car. It is the expectation to have the team ready for its initial bow at the Indianapolis Memorial Day races.

Beecroft to Study Car Market in South America

NEW YORK CITY, April 19—With the object of investigating the automobile selling field in South America for cars, trucks and tractors, David Beecroft, directing editor of THE AUTOMOBILE, sails on April 29 for an extended business trip in Brazil, Uruguay, Argentina and Chile. Mr. Beecroft goes as a member of the Latin-America Return Visit Committee, which goes at the invitation of the Government to investigate into and report on various lines of industry.

The possibilities of the South American field have been under investigation

by several American makers for some years, but it is only since the present European war that the matter has received increased attention, and since then the large home consumption has held back the export business to that country.

South America is a land of wonderful distances and naturally a place well suited for power vehicles of all kinds. One country—namely, Brazil—is larger than the entire United States. The great farming country of Argentina is larger than all of the United States east of the Mississippi River. Chile on the map of South America looks like a small strip of country, yet it is longer than from New York to San Francisco.

A Consumer Market

South America offers many chances as a consumer market for motor vehicles. In Argentina the farmers till large areas and have plenty of money to buy trucks and cars. The lack of roads has hampered the movement. The entire country is as level as a table, and in that sense is ideal for motor transport; but it lacks stone to build roads, and up to the present has not seriously undertaken any progressive road policy.

Throughout South America are many fruitful fields for motor transportation. Such industries as coffee, wine, sugar, cotton, rice, lumber, agriculture, mining, etc., will require motor trucks in great quantities as soon as the road movement gets under way. At present there are many trucks in use, but the European governments have done most of the pioneering work. The city of Rio de Janeiro, Brazil, has for many years been a great truck city. The streets are well paved, as are practically all large cities in South America. Italy and France have had a large hold on the Rio truck trade.

K. & S. Tire Enters Field

GUELPH, ONT., April 14—The K. & S. Canadian Tire Co., Ltd., which introduced the Kelly-Springfield tire into Canada, is now manufacturing at its Guelph factory K. & S. tires, which are guaranteed for 7000 miles on Ford cars and 6000 miles on other cars.

Autocar Adds 85,000 Sq. Ft.

ARDMORE, PA., April 14—The Autocar Company, this city, is to erect another factory on Greenfield Avenue, directly opposite the present road testing plant. This new building will have 85,000 sq. ft. of floorspace and will be devoted entirely to the manufacture and painting of Autocar bodies and the final assembly of body and chassis. It will be two stories high, with a main building, two L extensions, a boiler house and blacksmith shop. The building will be divided into zones, each one a complete plant in itself.

Car to Have Beijer Transmission

Hydraulic Device to Be Feature of New Car—To License Others

STEVENS POINT, WIS., April 13—The Beijer Hydraulic Transmission Co., organized in the spring of 1915 at Stevens Point, Wis., by Arthur Beijer, a Swedish engineer, will complete the first model of car employing the Beijer patented transmission about May 1, and after road tests and further experimentation will build the car for the market and license other manufacturers on a royalty basis.

The Beijer transmission has been built into a 50-hp. touring car at the Stevens Point Garage Co.'s plant. The new form of transmission operates on the same principle as the hydraulic jack. A three-cylinder rotary pump is attached to the flywheel of the motor and pumps columns of oil through pipes to motors on each wheel of the car, front and rear. Thus a form of four-wheel drive is attained. The device makes it possible to eliminate clutch, gearbox, universal joints, differential and other expensive parts of the present-day car.

The new system is under the observation of engineers of note in all parts of the country, as well as the government. The same principle is adaptable to the system of control of turrets on battleships and coast defenses and any type of transmission.

Mr. Beijer is an expert on transmissions and has experimented with the hydraulic transmission for many years.

To Make Harroun Kerosene Carbureter in Pittsburgh

PITTSBURGH, PA., April 13—The Kerosene Carbureter Co., this city, has secured the patent and other papers necessary for manufacturing carbureters using kerosene instead of gasoline.

The carbureter manufactured by this company is the invention of Ray Harroun, formerly chief engineer of the Maxwell Motor Co., and now manufacturing aero motors.

Thomas Auto Truck Co. Formed in New York City

NEW YORK CITY, April 14—The Thomas Auto Truck Co. has been formed to build trucks in this city at 639-641 West Fifty-first Street. The line will consist of a $\frac{3}{4}$, 1, 1½, and 2-ton chassis, and complete bodies and also a line of taxicabs.

The personnel of the company is as follows: C. K. Thomas, president and

founder, was for three years previous vice-president and general manager of the Federal Motor Truck Co., of New York. Cloyd Marshall, the secretary and treasurer, was formerly with C. W. Hunt Co., this city. W. S. Thomas, a director, has been prominent in engineering work for a number of years, and was formerly with J. M. Guffey & Co., Pittsburgh, Pa. O. S. Platt, another director, is the owner of the Platt Pattern and Machine Works, Bridgeport, Conn. P. F. Donohue, also a director, is general advertising expert and treasurer of Tammany Hall. G. E. Whitney, M. E., of Bridgeport, Conn., is acting in the capacity of advisory engineer. M. D. Herron, the sales manager, formerly occupied the same position with the Federal Motor Truck Co., this city. W. A. Jones, the chief engineer, has been identified in a mechanical way with the automobile industry for fourteen years. He has been associated with Amplex, Packard and Fiat.

\$3,865,000 Record Business for Chalmers in March

DETROIT, MICH., April 17—The Chalmers Motor Co. reports that during the twenty-seven working days of March the value of cars shipped was \$3,865,000, indicating the greatest year's business in the history of the concern. On March 31, there were \$300,000 worth of Chalmers machines shipped, the record day since the formation of the company. Although new sales and production records have been established in the past three months, Sales Manager Paul Smith says that Chalmers entered the month of April with \$8,400,000 worth of orders on its books. Chalmers dealer representation has also rapidly increased, more than 1000 cities and towns in the United States now claiming a dealer for this make of car.

Chalmers Gets Canadian Plant

FORD, ONT., April 15—The Chalmers Motor Co. of Canada, Ltd., which was recently organized with a capital stock of \$1,000,000 has leased for a period of five years the factory of the Tate Electric Car Co., and will thus be able to start manufacturing here in Canada within a few weeks.

Duesenberg Motor in New Plant

CHICAGO, ILL., April 17—The Duesenberg Motor Co. moved to its new plant at 2259 Oakdale Avenue, this city, on April 15. The new factory gives the company greatly increased facilities, as compared with its St. Paul plant.

Pullman May Expand Plant

YORK, PA., April 13—The Pullman Motor Car Co., this city, is contemplating

building a new plant on a 40-acre tract at Grantley Station. The matter will be presented before a meeting of the board of directors to be held in the near future.

The present quarters are inadequate. The company is very busy at the present time. The past month's output was 900 cars, and it is expected that next month's production will number 1000.

If it is decided to build a new plant, it will be started at once. The old plant will be gradually transferred to the new one, and in about a year, it is believed, the entire Pullman establishment will be located at Grantley.

Willard Builds 1,000,000 Batteries

CLEVELAND, OHIO, April 14—On Saturday, April 8, the total production of automobile lighting and starting batteries by the Willard Storage Battery Co., this city, reached the total of 1,000,000. Production in the company's new plant has increased rapidly during the past year, while over 725 Willard service stations are in operation in all parts of the country. The company reports that its plan of giving free inspection once a month to any car owner, regardless of the make of battery he used, has worked out very successfully.

Hupp Production Gains 69%

DETROIT, MICH., April 15—According to Lee Anderson, commercial manager of the Hupp Motor Car Corp., March was the biggest business month in the concern's history. Production was 69 per cent larger than in March, 1915. During the first three months of 1916 business was 70 per cent ahead of what it was during the first quarter of 1915. Prospects for a continued increase of business are reported by the Hupmobile dealers and distributors.

Pathfinder Reports Big Gain

INDIANAPOLIS, IND., April 15—The Pathfinder Co., this city, reports that sales are now running 100 per cent ahead of production, which is now at the rate of 200 per cent over the same period in 1915. The number of cars shipped since Jan. 1 increased 400 per cent in January, 270 per cent in February and 226 per cent in March over the corresponding periods of 1915.

New Era Spring Gets Plant

DETROIT, MICH., April 15—The New Era Spring & Specialty Co. has acquired the plant of the National Shock Absorber Co., Grand Rapids, Mich., which had been making shock absorbers and bumpers for the New Era company. The offices of the company will remain in Detroit.

Columbia Axle Adds 75 Per Cent

Production Increased 100 Per Cent—200 Men Added to Force

CLEVELAND, OHIO, April 15—The plant of the Columbia Axle Co., this city, has recently added 75 per cent more floorspace and with the new equipment installed the production of axles immediately jumped 100 per cent over the former capacity.

A feature of the new factory building is a sound-proof testing room. Specially constructed walls shut out all sound from this room. The floors and testing racks are of concrete with very solid foundations. Each axle before it receives the final O. K. is tested in this room under the supervision of trained inspectors. The axle is connected to an electric motor and the slightest noise is instantly detected and corrected before the axle is shipped.

Two hundred new men have been added to the factory force. The Columbia company manufactures both front and rear axles for passenger cars and supplies Cole, King, National, Monarch, Daniels, Davis, Auburn and others.

Crow Business Gains 100 Per Cent Over 1915

SOUTH BEND, IND., April 17—Automobiles reaching a total valuation of \$155,700 were built and shipped by the Crow Motor Car Co., of Elkhart, Ind., during the month of March. This represents a 100 per cent increase in business over the same period last year, and places the Crow company among the leaders of Indiana automobile manufacturers in point of production. By the end of the year a company official estimates that fully 3000 cars will have been built and sold by the firm. The Crow company has at present 241 people on its payroll. Since Nov. 1, 1915, the company has expended \$40,000 on buildings and factory extensions and another new building 60 ft. wide and 100 ft. long and two stories in height is to be built soon.

Spicer to Increase Capacity

PLAINFIELD, N. J., April 14—The Spicer Mfg. Co. is at present busier than ever before and is finding its capacity taxed to the utmost in order to keep pace with the demands of automobile manufacturers. The present output exceeds 500,000 universal joints per year and this will be increased to 65,000 a month as soon as new machinery is obtained. A large amount of new plant has been on order for months past and deliveries

are expected very shortly. The bulk of the Spicer business is done with six sizes of joint, though there are small variations within each size, to take care of different methods of attachment required for different transmissions and axles. C. W. Spicer reports that axle and gear-box makers are rapidly adopting the S. A. E. standard tapers for their shafts, and that the variations in design are thus being cut down greatly; the special patterns are mostly for chassis of older design.

Republic Truck to Expand

ALMA, MICH., April 15—The Republic Motor Truck Co., will erect an addition, 60 by 500 ft., to its plant, thus increasing the total floorspace by 30,000 sq. ft. The working force, which is now about 700 men, will be greatly increased, as will production, which is now at the rate of 30 trucks a day.

Saxon Ships 1086 Cars First Nine Days of April

DETROIT, MICH., April 17—For the first nine working days of April, the Saxon Motor Corp. shipped 1086 cars, making an average of 120 per day. As the record month so far was March with 2604 shipped, it seems more than likely that this record will fall before the April total, which would be over 3000 cars if the present rate continues during the entire month. In January, 1556 Saxons were shipped, and 2231 in the following month.

Fire Fails To Stop Silvex

NEW YORK CITY, April 17—Despite a fire which considerably damaged the factory of the Silvex company, there has been no interruption in the company's business. Arrangements have been completed for the use of a neighboring building and there will be no delay in deliveries. When final arrangements are completed manufacturing facilities will be considerably increased.

Two New Members for M. and A. M.

NEW YORK CITY, April 15—The Detroit Gear & Machine Co., Detroit, Mich., maker of transmissions, clutches and transmission gears, and the G. Piel Co., Long Island City, maker of Long horns and muffler cut-outs, have become members of the Motor and Accessory Manufacturers, this city.

To Make Accessories Invented by Buick

JACKSON, MICH., April 13—The rights to manufacture a number of automobile parts and accessories invented by David E. Buick, have been secured by a corporation, soon to be announced, which will begin manufacturing them here. A new carburetor is to be one of the first things to be placed on the market.

February Exports Show Gain of 138.7 Per Cent Over February, 1915

7714 Motor Vehicles Shipped Abroad in That Month

—Total Comprised 5651 Passenger Cars Valued at \$4,063,429 and 2063 Trucks Worth \$6,170,367

WASHINGTON, D. C., April 15—There was a large increase in the exports of automobiles and parts in February last, as compared with the same month of last year. According to figures compiled by the Department of Commerce, the exports in February last were as follows: Commercial cars, 2063, valued at \$6,170,367; passenger cars, 5651, valued at \$4,063,429; parts, not including tires and engines \$2,173,409. For the month of February, 1915, the exports were 1002 commercial cars, valued at \$3,022,482; passenger cars, 2230, valued at \$1,785,330; parts, not including engines and tires, \$564,976.

A Huge Gain

For the eight months' period ended February, 1916, the increase in exports was even greater than during the month's period. During February last, the exports of commercial cars reached the number of 14,467 machines, valued at \$38,729,721, while the exports of passenger cars reached a total of 33,256 cars, valued at \$25,534,507. The exports of parts, not including engines and tires, were valued at \$14,965,360.

The exports for the same period of 1915 look insignificant in comparison with the above figures, the shipments of commercial cars amounting to only 4974 machines, valued at \$14,011,924, while the exports of passenger cars totaled 9134 cars, valued at \$7,593,429. The value of the parts exports, not including engines and tires, was \$3,354,222.

The warring countries in Europe are largely responsible for the large gains that have been made in the automobile export trade. Russia is branching out as a buyer of American machines, 335 of them, valued at \$1,514,729, having been shipped there in February last, while during the eight months' period of 1916, the shipments reached a total of 4568 vehicles, the value of which was \$14,338,776. Russia did not figure in the export tables last year.

Naturally, the United Kingdom continues to head the list of countries importing American cars. The figures show that in February last 1169 cars, valued at \$1,763,079 were shipped there while during the eight months' period the number was 14,740 and the value \$20,377,746. This is a big gain over the figures for the same periods of last year, when 1183 cars, valued at \$1,688,313, were exported in February and 4631 cars, valued at \$6,447,015, during the eight months ended February.

France, too, continues to receive large shipments of American cars, 1027, valued at \$2,804,931, being exported there in February, 1916, as against 412, valued at \$1,389,599, shipped in February a year ago. For the eight months' period the exports rose from 2436 cars, valued at \$6,407,087, in 1915, to 4199 cars, valued at \$10,798,226, in 1916.

16 Cars to Germany

There were no shipments of cars to Germany in February last or during the

eight months' period of this year, but during the eight months of 1915 there were sixteen cars, valued at \$17,364, exported to that country. Italy is purchasing few American cars, only twenty-three, valued at \$18,558, being shipped there in February last, as against sixteen, valued at \$11,390, in February a year ago, while during the eight months' period the shipments rose from forty-two cars, valued at \$35,112, in 1915, to 207 cars, valued at \$146,144, in 1916. Little Denmark, which is just beginning to figure in the export tables, took twenty-seven cars, valued at \$18,468, in February, while during the eight months' period of this year the number was 469 and the value \$314,905. Other European countries imported 281 cars from this country in February last, the value being \$301,082, as against 131 cars, valued at \$406,368, in February a year ago, while during the eight months' period the exports amounted to 832 cars, valued at \$2,300,646, in 1915, and 940 cars, valued at \$975,010, in 1916.

Canada Still Gains

A big increase is noted in the shipments to Canada, 947 cars, valued at \$593,492, being shipped there in February last, as against 349 cars, valued at \$345,733, exported during the same month of last year. The figures for the eight months' period are even more impressive, no less than 4287 cars, valued at \$3,033,808, being shipped across the northern border during the eight months of this year, as against 1727 cars, valued at \$2,236,426, exported during the corresponding period of last year.

The West Indies and Bermuda are becoming good customers for American cars and this is a market apparently worth cultivating. Five hundred and thirty-eight cars, valued at \$366,188, were exported there in February last, this

Exports of Automobiles, Trucks and Parts for February and 8 Previous Months

| | February 1915 | | February 1916 | | Eight months ending February 1915 | | Eight months ending February 1916 | |
|--|---------------|-------------|---------------|--------------|-----------------------------------|--------------|-----------------------------------|--------------|
| | Number | Value | Number | Value | Number | Value | Number | Value |
| Commercial | 1,002 | \$3,022,482 | 2,063 | \$6,170,367 | 4,974 | \$14,011,924 | 14,467 | \$38,729,721 |
| Passenger | 2,230 | 1,785,330 | 5,651 | 4,063,429 | 9,134 | 7,593,429 | 33,256 | 25,534,507 |
| Total | 3,232 | \$4,807,812 | 7,714 | \$9,233,796 | 14,108 | \$21,605,353 | 47,723 | \$64,264,228 |
| Parts (not including engines and tires)..... | ..... | 564,976 | ..... | 2,173,409 | ..... | 3,354,222 | ..... | 14,965,360 |
| Total ..... | ..... | \$5,372,788 | ..... | \$12,407,205 | ..... | \$24,959,575 | ..... | \$79,229,588 |
| BY COUNTRIES | | | | | | | | |
| Denmark ..... | ..... | ..... | 27 | \$18,468 | ..... | ..... | 469 | \$314,905 |
| France | 412 | \$1,389,599 | 1,027 | 2,804,931 | 16 | 17,364 | ..... | ..... |
| Germany ..... | ..... | ..... | ..... | ..... | 4,199 | 10,798,226 | 2,436 | \$6,407,087 |
| Italy | 16 | 11,390 | 23 | 18,558 | 42 | 35,112 | 207 | 146,144 |
| Russia ..... | ..... | ..... | 335 | 1,514,729 | ..... | ..... | 4,568 | 14,338,776 |
| United Kingdom | 1,183 | 1,688,313 | 1,169 | 1,763,079 | 4,631 | 6,447,015 | 14,740 | 20,377,746 |
| Other Europe | 131 | 406,368 | 281 | 301,082 | 832 | 2,300,646 | 940 | 975,010 |
| Canada | 349 | 345,733 | 947 | 593,492 | 1,727 | 2,236,426 | 4,287 | 3,033,808 |
| Mexico | 10 | 6,347 | 57 | 70,210 | 49 | 54,774 | 226 | 238,526 |
| West Indies and Bermuda..... | 183 | 98,630 | 538 | 366,188 | 651 | 439,642 | 2,708 | 1,712,084 |
| South America | 132 | 66,767 | ..... | ..... | 603 | 337,452 | ..... | ..... |
| Argentina ..... | ..... | ..... | 380 | 214,325 | ..... | ..... | 2,635 | 1,199,860 |
| Brazil ..... | ..... | ..... | 34 | 23,465 | ..... | ..... | 144 | 89,521 |
| Chile ..... | ..... | ..... | 54 | 35,295 | ..... | ..... | 540 | 373,389 |
| Venezuela ..... | ..... | ..... | 24 | 14,010 | ..... | ..... | 301 | 198,185 |
| Other South America..... | ..... | ..... | 78 | 43,236 | ..... | ..... | 332 | 190,070 |
| British East Indies..... | ..... | ..... | 230 | 170,158 | ..... | ..... | 1,859 | 1,400,401 |
| British Oceania..... | 526 | 451,706 | 598 | 597,661 | 1,880 | 1,536,591 | 4,005 | 3,403,917 |
| Asia and other Oceania..... | 131 | 197,433 | 1,564 | 497,523 | 814 | 1,443,677 | 3,291 | 867,727 |
| Other Countries | 159 | 145,526 | 348 | 187,386 | 427 | 349,567 | 2,272 | 1,605,933 |
| Total | 3,232 | \$4,807,812 | 7,714 | \$10,233,796 | 14,108 | \$21,605,353 | 47,723 | \$64,264,228 |

being a considerable gain over the figures for the same month of last year, which were 183 cars, valued at \$98,630. The gain during the eight months' period was much greater, the exports increasing from 651 cars, valued at \$439,642, in 1915, to 2708 cars, valued at \$1,712,084, in 1916.

Heretofore it has been customary to group all the exports to South America under one head. The increase in the shipments to those countries has justified the Department in giving separate enumeration to the various countries, and it is interesting to note that while the combined exports in February a year ago were only 132 cars, valued at \$66,767, Argentina alone in February last imported 380 cars, valued at \$214,325. Again, during the eight months' period the combined exports to South America amounted to 603 cars, valued at \$337,452, while Argentina during the same period of this year imported 2635 cars, valued at \$1,199,860. Shipments to other European countries during the eight months of this year were as follows: Brazil, 144 cars, valued at \$89,521; Chile, 540 cars, valued at \$373,389; Venezuela, 301 cars, valued at \$198,185; other South American countries, 332 cars, valued at \$190,070.

East Indies Buy Many Cars

The British East Indies are also looming up large as buyers of American cars, 230 of them, valued at \$170,158, having been shipped there in February last, while during the eight months of this year the number was 1859 and the value \$1,400,401. British Oceania took 598 American cars in February last, the value being \$597,661, while during the eight months' period the number was 4005 and the value \$3,403,917. Other Asia and Oceania figured in the export trade to the extent of 1564 cars, valued at \$497,523, in February last, while the shipments during the eight months of this year reached a total of 3291 cars, valued at \$867,727.

The detailed figures, by countries, for comparative periods, appear in the accompanying tabulation.

S. F. Bowser Honored

FORT WAYNE, IND., April 15—S. F. Bowser, head of the Bowser Oil Tank and Pump Co. of Fort Wayne has been elected president of the Erie & Michigan Deep Waterways Assn.

Prof. Morton Joins Ambu Maker

CHICAGO, ILL., April 13—Professor Morton of the Armour Institute has joined the engineering staff of the American Bureau of Engineering, which at the present time is manufacturing a device for detecting and locating trouble in the electric starting and lighting systems of automobiles, called the Ambu Electric Trouble Shooter.

Dept. of Justice To Investigate?

May Undertake Gasoline Price Probe Independent of Trade Commission's Action

WASHINGTON, D. C., April 14—With Congress in receipt of the preliminary report of the Federal Trade Commission on the gasoline situation, as set forth in last week's issue of THE AUTOMOBILE, there is a persistent rumor afloat in Washington that the Department of Justice is preparing to institute an investigation of the subject apart from the investigation being made by the trade commission. Color is given this rumor by the action of Attorney General Gregory in declining to give the Senate information sought in the Kenyon resolution regarding the results of the investigation of the working of the supreme court's Standard Oil decree. The attorney general maintains that it would not be compatible with the public interest to give out the desired information.

The belief that the Department of Justice is going to delve further into the gasoline situation is further strengthened by the fact that department officials recently have been in frequent consultation with Charles B. Morrison of Chicago, who took part in prosecuting the dissolution suit against the Standard Oil Co., and is said to have conducted investigations since the dissolution of the trust, on behalf of the department, to determine whether the so-called subsidiaries have violated the anti-trust law since the decree was entered. The department's investigations are said to have disclosed that the so-called Standard Oil companies are not competing and that the stock ownership of the companies has not materially altered. Inasmuch as the decree permitted an unchanged ownership, present officials of the department have confined their efforts largely to determining whether any new violations of law were involved by the company.

A. C. A. May Test Water Fuel

FARMINGDALE, N. Y., April 18—Louis Enricht, of this town, who announced a few days ago that he had discovered a chemical which when mixed with water gives a fuel superior to gasoline, states that he has been experimenting for three years on chemicals which when added to water would produce a fuel and about three months ago discovered the compound which would produce the desired result. Up to within a few days ago his experiments have been performed upon his own three cars and those of neighboring garages. He then announced his dis-

covery and made demonstrations to all who called until visitors became so frequent that it was impossible to satisfy them all. He has now decided that he will either sell the secret to the United States Government to dispose of as it wishes or to the automobile industry.

In explaining his compound to a representative of THE AUTOMOBILE, Mr. Enricht stated that the preparation could be made in either powdered or liquid form. In the form in which he used it it was prepared in a liquid solution, of which 4 oz. is enough to treat 5 gal. of water. The chemical, he states, remains in solution with the water in the tank until the water reaches the carbureter, at which time it is separated into hydrogen gas and oxygen. The hydrogen is used for combustion and the oxygen combines with the chemicals introduced. He also says that it is a peerless carbon remover and has more power than gasoline. It can be used in any needle valve carbureter, according to Mr. Enricht, but on a jet carbureter requires a larger nozzle. The cost figures at 1½ cents per gallon of mixture. He intends making a private test at the Automobile Club of America, but claims to be afraid of analysis of his fuel, which he says is simple.

Chemists and fuel experts have received the story of the new fuel with much reservation, pointing out that the energy necessary for the dissociation of water is as great as that secured by the recombination of the gases. They state that they know of no chemical which could possibly produce any such effect as described.

Motorzine—Another Gasoline Substitute

ST. LOUIS, Mo., April 15—Motorzine, a substance invented by W. H. Stevens of St. Louis, to supply a cheaper substitute for gasoline, has been given exhaustive tests during which it is stated that an average of 27 m.p.g. was made. When mixed with crude oil or coal oil, the new fuel clarifies it at once, and the heavier oil does not carbonize, according to reports. The inventor claims it will be possible to make it for about 3 or 4 cents a gallon in 1,000,000 gal. lots.

E. V. A. A. To Standardize Lamps

CHICAGO, ILL., April 17—Suggestions on the question of standardizing lamps for electric vehicles were sought at a meeting of the Chicago section of the Electric Vehicle Assn. to-day, the information so obtained to be used by the standardization committee in preparing recommendations soon to be submitted. W. F. Bauer, chairman of the committee, explained several points which are in debate and must be disposed of to accomplish the committee's purpose. The standardization of charging devices will be undertaken at a later date.

N. E. Feels Freight Embargo

Increased Rates a Result of Freight Car Shortage—Some Cars Expressed

BOSTON, MASS., April 15—Increased freight rates for the buyers of automobiles is the latest thing that some of the purchasers of cars in New England face now and have been facing for a few weeks. The freight embargo presented a new angle when some of the Boston dealers were told that the railroads would not route their machines through to Boston and other New England cities direct.

They were told that New York and Albany would be the limit because of the need of cars, and also to insure, probably, that the freight cars would not be held too long in New England. Some of the dealers had to accept the inevitable and route their cars to Albany or New York. At those points the machines had to be transferred from the Western lines to cars of the New York, New Haven and Hartford, Boston & Maine and Boston & Albany railroads.

That necessitated hiring men there to make the shift. In some cases fenders had to be taken off to get the cars into smaller freight cars that had no end doors. When the machines reached Boston there was the work of putting the cars together again. On some of the machines the freight charges have represented about \$20 more. Some of the dealers did not feel like adding this to the cost and so they cut it in two, standing half of it themselves. Others paid the entire excess freight over the normal. The dealers do not like to talk about it because they feel prospective buyers will be scared away. The cars that come on the gondola flat cars provided with canvas covers and frames are costing some of the dealers a little more, in some cases the cost of the covers being charged to them, but when they are returned they are allowed a rebate. In a few instances buyers have agreed to pay express charges to get cars quickly, but they are very few.

Stover Mfg. & Engine Co. To Be Capitalized at \$3,000,000

FREEPORT, ILL., April 15—The Stover Engine Works and the Stover Mfg. Co., this city, will be merged into a new corporation to be known as the Stover Mfg. & Engine Co. The new corporation will be capitalized at \$3,000,000.

This concern will manufacture the Stover tractor, the first model of which was turned out the latter part of March. This company expects to turn out about

100 of these tractors this year. One of the features of this tractor, is the use of cross cleated wheels in the rear. When the tractor is used in sod or stubble plowing, extra spurs are furnished, twenty-four to each wheel, which contribute to the footing of each wheel. The four-cylinder motor is rated at 40 hp. A Bennett carbureter and air cleaner is part of the equipment.

May Lower Freight Rates from Milwaukee to South

MILWAUKEE, WIS., April 15—Material reductions in the freight rates on pressed steel frames and other automobile parts from Milwaukee to southern points are in prospect as the result of the appeal of the Dorris Motor Car Co., St. Louis, Mo., to the Interstate Commerce Commission. The A. O. Smith Co., Milwaukee, Wis., recently shipped 202 automobile gear frame side bars, loose, weighing 23,000 lb., from North Milwaukee to St. Louis. The first class rate of 49.3 cents per 100 lb. was charged. The commission held the rate to be unreasonable and changed the rate to third class, amounting to 31.5 cents per 100 lb. Future shipments will take that rate.

American Rubber & Tire Co. Organization Completed

AKRON, OHIO, April 15.—The American Rubber & Tire Co. has been organized here and has purchased and succeeded to the business of the American Tire & Rubber Co. The new company is composed of experienced rubber men and the officers are: Fred. H. Snyder, president; Chas. Dietz, vice-president; Geo. W. Kratsch, secretary and treasurer; Henry L. Houk, general manager and assistant treasurer, and J. W. Rock, factory manager.

A two-story addition to the plant is in course of construction, and the company is making a complete line of tires and accessories, including American Indian red tubes, 5-min.-cure vulcanizing cement, repair materials and accessories.

McEvoy Heads American Top

JACKSON, MICH., April 13—The American Top Co. has been reorganized and J. A. McEvoy, of New York, has become president and general manager, while G. H. Quennard, who was president, has sold out his interest and retired from the company. E. G. Odette, who was secretary, treasurer and general manager, has also withdrawn from the company.

Anti-Friction Lubricant Co. Formed

ST. JOSEPH, MICH., April 12—The Anti-Friction Lubricant Co. has been formed with a capital stock of \$20,000 to make all kinds of lubricants. A factory has been secured.

Steamers Relieve Freight Tie-Up

Situation Somewhat Improved to Points in Ohio—Otherwise Unchanged

DETROIT, MICH., April 17—With the opening up of navigation on the Great Lakes, the freight car situation will be relieved to some extent. Steamers of the Detroit and Cleveland Navigation Co. have been operating daily between this city and Cleveland now for one week, and there is a great traffic in cars to that city. Thus the distribution to Ohio points from Cleveland is now practically independent of the rail lines. The same will be true of cars for Buffalo and adjacent points when the boats begin operating from Detroit to Buffalo. The regular schedules to Buffalo will probably go into effect within two weeks.

There seems little change in the freight car situation this week so far as the automobile shippers are concerned. It may be that there is a slightly easier feeling, but even if a greater number of freight cars are available due to the lifting of embargoes by some of the eastern roads, the steadily increasing output of the factories quickly absorbs the greater supply of freight cars so that there is practically as great a shortage as ever, when the number of cars needed is considered. Makers are still shipping large numbers of machines on flats and gondolas with tarpaulins and board superstructures over them.

A meeting of the traffic managers of the various factories was held at the Board of Commerce here on April 13, and the present status of the situation was discussed at length. One factor which works against an adequate supply of the right kind of cars is the misuse of the automobile equipment by southern rail lines and shippers who are in the habit of appropriating the automobile cars for other lines of shipping. It is hoped to relieve this situation by conference with officials of these roads by a sub-committee appointed at the meeting of April 13. This conference will be held at the meeting on April 20 in Atlanta, Ga., of the Southern Assn. of Car Service Officers.

Demurrage Rates Higher

By a regular campaign among their dealers a great many of the manufacturers are seeking to prevent tie-up of cars at their destinations due to the tardiness of some dealers in unloading the automobiles. This is having a very good result generally. Although the demurrage rate was increased on April 1 to \$2 a day after five days, the railroads are seeking to have a temporary rate of \$5 per day to prevent holding cars.

DETROIT, MICH., April 15.—A final dividend of about 7½ per cent is to be mailed soon to the creditors of the bankrupt R-C-H Corp. for which the Security Trust Co. has been trustee. The amount involved is about \$37,000 and will bring up the total paid to secured claims to

\$194,000 and to \$211,000 on unsecured claims, since November, 1913. The concern failed in October, 1912. All told about 65 per cent of the approved claims of those creditors who extended credit will have been paid, while about 12½ per cent will have been paid to those who did not sign the extension agreement. The debts of the R-C-H Corp. totaled \$1,800,000.

Toledo Machine and Tool Capital Now \$3,000,000

TOLEDO, OHIO, April 13—The capital stock of the Toledo Machine and Tool Co. has been reduced from \$6,000,000 to \$3,000,000. This is \$1,800,000 more than the original capitalization which was \$1,200,000, prior to Dec. 22, last. It was then increased to \$6,000,000 when eastern capital became interested in the plant.

Saginaw Company Capital Is \$100,000

SAGINAW, MICH., April 13.—The Saginaw Motor Car Co., with a capital stock of \$100,000, has been organized and will make the Yale eight, to sell at \$1,285. The officers of the company are: John A. Cimmerer, president; J. Will Grant, vice-president; W. C. Wiechmann, secretary; Harry E. Oppenheimer, treasurer; L. J. Lampcke, general manager and engineer.

Standard Co. Has \$1,000,000 Capital

DOVER, DEL., April 13—The Standard Car Construction Co., with a capital of \$1,000,000, has been formed to manufacture automobiles and trucks. The incorporators are all from Philadelphia and include F. R. Hansell, G. H. B. Martin, and S. C. Seymour.

Tire Securities Are Strong

Goodyear, Firestone, Miller Rubber and Portage Show Large Gains

NEW YORK CITY, April 18—Much strength was shown by the tire issues last week and as a result a majority of the issues closed on Saturday with large gains. Tire issues were very buoyant while the others were dull. Goodyear, Firestone and Miller Rubber, chalked up gains ranging from 30 to 35 points, while Portage Rubber rose 5 points. The strength of these and other tire stocks is said to be due to a certain extent to the large automobile production this year with the consequent demand for tires and the fact that the price of crude rubber has had another decline.

Automobile issues were less in demand last week with a consequent drop in prices. General Motors featured the decline with a 20-point drop on its common; Chalmers went down 9 points; Chevrolet after a 21-point rise the previous week, dropped 6 points; Studebaker dropped 3 points, Maxwell common ½ points, the first preferred ½ point, and the second preferred 2½ points; and Willys-Overland dropped 2 points.

Maxwell is being purchased by professionals on a rumor that the common stock is to get a 10 per cent dividend soon and the second preferred 6 per cent. All the back dividends have been disposed of by the recent distribution of 14¼ per cent in non-interest bearing warrants.

Apropos of the increased demand in tire issues this week, reports of large earnings by the tire companies have no doubt been the cause of much activity in these stocks. It is stated that earnings by the Ajax Rubber Co. this year are running far in excess of any previous year, and earnings of between \$800,000 and \$1,000,000 are being predicted. This company will increase its production to three times its present capacity.

Auburn Ignition Increases Capital

AUBURN, N. Y., April 15—The Auburn Ignition Mfg. Co., Inc., this city, manufacturer of spark plugs, valve lifters, etc., has increased its capital from \$25,000 to \$60,000, in order to secure more efficient manufacturing facilities and working capital. The management of the company will continue with S. M. Kitchen, general manager; C. A. Frank, production manager; and H. G. Kitchen, sales manager.

Chelsea Screw Co. Reorganized

CHELSEA, MICH., April 11—The Chelsea Screw Co. has been reorganized. Its capital stock is now \$50,000 instead of \$18,000. A new large addition is to be put up and a number of automobile parts are to be produced.

To Boom N. E. by Abolishing Motor Law Restrictions

BOSTON, MASS., April 15—If the plans now under way here are brought to a head, and there is no reason to doubt their success, many thousands of dollars will be spent to boom New England which will result in drawing thousands of motorists to the section. At a meet-

Automobile Securities Quotations on the New York and Detroit Exchanges

| | 1915 | | 1916 | | Wk's |
|---|------|-------|------|-------|-------|
| | Bid | Asked | Bid | Asked | Ch'ge |
| Ajax Rubber Co. (new)..... | .. | .. | 67½ | 69 | -2 |
| Aluminum Castings pfd..... | 98 | 100 | .. | .. | .. |
| J. I. Case pfd..... | 78 | 87 | 87 | 90 | ½ |
| Chalmers Motor Co. com..... | 93 | 98 | 150 | 160 | -9 |
| Chalmers Motor Co. pfd..... | 89 | 91 | 97 | 100 | -1 |
| Chevrolet Motor Co..... | .. | .. | 185 | 187 | -6 |
| Electric Storage Battery Co..... | 51¾ | 52½ | 60 | 62 | -1½ |
| Firestone Tire & Rubber Co. com..... | 453 | 460 | 800 | 814 | +35 |
| Firestone Tire & Rubber Co. pfd..... | 110 | 112 | 114 | 115 | +1 |
| General Motors Co. com..... | 143 | 144½ | 430 | 450 | -20 |
| General Motors Co. pfd..... | 101 | 102 | 115 | 117 | ½ |
| B. F. Goodrich Co. com..... | 49 | 51 | 76¾ | 77½ | ¾ |
| B. F. Goodrich Co. pfd..... | 101½ | 102½ | 115 | 117 | ½ |
| Goodyear Tire & Rubber Co. com..... | 240 | 245 | 370 | 390 | +34 |
| Goodyear Tire & Rubber Co. pfd..... | 104 | 106 | 114 | 116 | +1 |
| Gray & Davis, Inc., pfd..... | .. | .. | .. | .. | .. |
| International Motor Co. com..... | 13 | 15 | 13 | 17 | -4 |
| International Motor Co. pfd..... | 32 | 34 | 25 | 35 | -5 |
| Kelly-Springfield Tire Co. com..... | 136 | 137 | 72½ | 73 | ½ |
| Kelly-Springfield Tire Co. 1st pfd..... | 136 | 138 | 96 | 98 | .. |
| Kelly-Springfield Tire Co. 2d pfd..... | .. | .. | .. | .. | .. |
| Maxwell Motor Co. com..... | .. | 54 | 72½ | 72½ | ¾ |
| Maxwell Motor Co. 1st pfd..... | .. | 86½ | 84½ | 85 | ½ |
| Maxwell Motor Co. 2d pfd..... | 39 | 40 | 54½ | 55 | -2½ |
| Miller Rubber Co. com..... | 185 | 190 | 265 | .. | +30 |
| Miller Rubber Co. pfd..... | 101 | 103 | 113½ | 114½ | +1½ |
| New Departure Mfg. Co. com..... | .. | .. | 181 | 184 | -1 |
| New Departure Mfg. Co. pfd..... | .. | .. | 111 | .. | .. |
| Packard Motor Car Co. com..... | 86 | .. | 165 | 175 | .. |
| Packard Motor Car Co. pfd..... | 93 | .. | 100 | 104 | .. |
| Paige-Detroit Motor Car..... | .. | .. | 750 | 850 | .. |
| Peerless Motor & Truck Corp..... | .. | .. | 25½ | 26½ | ½ |
| Portage Rubber Co. com..... | 34 | 36 | 75 | 77 | +5 |
| Portage Rubber Co. pfd..... | 85 | 95 | 108 | 109 | +2 |
| Regal Motor Co. pfd..... | .. | .. | 18 | 25 | +3 |
| *Reo Motor Truck Co..... | 13 | 14½ | 28 | 30 | .. |
| *Reo Motor Car Co..... | 32 | 34 | 39 | 40 | +3¾ |
| Splitdorf Electric Co. pfd..... | .. | .. | .. | .. | .. |
| Stewart-Warner Speed. Corp. com..... | 68 | 70 | 87 | 89 | +1 |
| Studebaker Corp. com..... | 66 | 67 | 138 | 140 | -3 |

| | 1915 | | 1916 | | Wk's |
|---------------------------------|------|-------|------|-------|-------|
| | Bid | Asked | Bid | Asked | Ch'ge |
| Studebaker Corp. pfd..... | 99 | 100 | 112 | 114 | .. |
| Swinehart Tire & Rubber Co..... | 90 | 95 | 84 | 86 | -4 |
| Texas Co..... | 142 | 144 | 189 | 191 | -6 |
| U. S. Rubber Co. com..... | 71 | 73 | 53 | 54 | +1½ |
| U. S. Rubber Co. pfd..... | 107 | 108 | 108 | 109 | -2 |
| Vacuum Oil Co..... | 208 | 210 | 240 | 243 | .. |
| White Motor Co. (new)..... | .. | .. | 49 | 52 | -1 |
| Willys-Overland Co. com..... | 128½ | 129½ | 228 | 230 | -2 |
| Willys-Overland Co. pfd..... | 101 | 102 | 104 | 105 | .. |

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

ACTIVE STOCKS

| | | | | | |
|---------------------------------|-----|-----|-----|------|-----|
| Auto Body Co..... | .. | .. | 31½ | .. | + ½ |
| Chalmers Motor Co. com..... | 90 | 93 | .. | 164 | +2 |
| Chalmers Motor Co. pfd..... | 92 | 95 | 97 | 99 | -1 |
| Continental Motor Co. com..... | 170 | 180 | .. | 38 | -1 |
| Continental Motor Co. pfd..... | .. | .. | 9½ | 10½ | .. |
| Ford Motor Co. of Canada..... | 600 | .. | .. | 405 | .. |
| General Motors Co. com..... | 146 | 150 | 410 | 450 | -30 |
| General Motors Co. pfd..... | 104 | 107 | 113 | 116 | - ½ |
| Maxwell Motor Co. com..... | 47 | 49 | 71 | 74 | + ½ |
| Maxwell Motor Co. 1st pfd..... | 84 | 86 | 83 | 86 | - ½ |
| Maxwell Motor Co. 2d pfd..... | 39½ | 41½ | 53½ | 56 | + ½ |
| Packard Motor Car Co. com..... | 86 | .. | 165 | 175 | .. |
| Packard Motor Car Co. pfd..... | 93½ | .. | .. | 103½ | - ½ |
| Paige-Detroit Motor Car Co..... | .. | .. | .. | 850 | .. |
| *Reo Motor Car Co..... | 32¾ | 33¾ | 38¾ | 39¾ | +4¾ |
| *Reo Motor Truck Co..... | 13 | 14 | 28½ | 29½ | +2 |
| Studebaker Corp. com..... | 67 | 69 | 136 | 140 | -2½ |
| Studebaker Corp. pfd..... | 100 | 103 | 111 | .. | .. |

INACTIVE STOCKS

| | | | | | |
|--------------------------------------|-----|-----|-----|-----|----|
| *Atlas Drop Forge Co..... | .. | 26 | .. | 40 | .. |
| Kelsey Wheel Co..... | 195 | .. | 320 | 365 | .. |
| *W. K. Prudden Co..... | 19 | 20½ | 29½ | 33 | .. |
| Regal Motor Car Co..... | 12 | 20 | 15 | 22 | +3 |
| Stewart-Warner Speed. Corp. pfd..... | 102 | 105 | 109 | .. | .. |

*Par value \$10.

ing here, there were 200 men representing the six States who agreed that the time had come to advertise their locality properly, and the master minds said that at least \$250,000 and if need be \$500,000 will be spent annually for the next five years to tell the glories of New England.

One of the first things that the organization will be asked to do is to wipe out all the existing provisions in the present motor laws which place restrictions upon motorists as it is recognized that there are now some bad sections in them.

Parrott Tractor Specifications Announced

JACKSON, MICH., April 15.—The specifications of the Parrott tractor which is being made by the Parrott Tractor Co., have been announced. The power plant will be a four-cylinder bloc motor, 3¼ by 4¼; carbureter, Schebler; ignition, Dixie; storage battery, Willard; roller bearings, Hyatt; radiator, Candler; wheels, Hayes; tires, Kelly-Springfield dual block tires; a two-unit starter and lighting system. Wheels of different width will be furnished according to the special work the tractor is destined to perform. It is planned to make 3000 tractors within the next twelve months.

Beeman Garden Tractor in Minneapolis

MINNEAPOLIS, MINN., April 17.—Another concern is to join the large local colony of tractor factories. The Beeman Garden Tractor Co. has been incorporated by E. R. Beeman, P. J. Lyons, A. G. Furber, P. H. Knoll and R. C. Brewsaugh. It will make a gasoline-driven garden cultivator, operated on foot. Beeman, manager of the Monitor Drill branch of the Moline Plow Co., and P. J. Lyons, president of the Bull Tractor Co., are the inventors.

Can't Cover Road With Tar

BOSTON, MASS., April 15.—Governor McCall has signed the bill put in by the Automobile Legal Assn. and passed by the Legislature prohibiting contractors on roads from spreading oil and tar across the entire width of a highway at a time.

To Dim Headlights at Portland

PORTLAND, ME., April 15.—The city council is framing an ordinance to prevent the use of glaring headlights within the city limits, and also to prohibit the use of muffler cut-outs.

To Continue Dealers' Contest Assn.

NEW YORK CITY, April 19.—The Motor Dealers' Association Contest Assn. has voted against dissolution.

The former officers were re-elected as follows: W. C. Poertner, president; Emanuel Lascaris, first vice-president; E. E. McShane, second vice-president; J. C. Nichols, treasurer, and E. F. Korbel, secretary.

Canada Buys 22,070 New Cars

Registrations Show Good Record for Past Year—17,570 Are Fords

OTTAWA, ONT., April 15.—Recent statistics show that of all automobiles licensed in the nine provinces of the Dominion of Canada during the past year the Ford car was chosen in a proportion of four times to one of all other makes combined. There were 22,070 cars sold in Canada in these twelve months. Of this number 17,570 were Fords, leaving a balance of 4500 cars of other makes. The number of Fords in the Dominion will be increased by nearly 40,000 by Aug. 1, 1916.

Several of the dealers report their sales up to date this season to be treble what they were at the same time last year, but hardly expect that this exceptional increase will be maintained throughout the season. They all agree, however, that 1000 cars will be well within the mark.

At an average of \$1,000 each this means an investment of a million dollars in cars in the district of which Ottawa is the center.

Out of 8616 licensed automobiles in Manitoba for 1915 there were 3452 Fords, 1004 McLaughlin-Buicks and 622 Overlands. In Saskatchewan, there are 3514 Fords, 742 McLaughlin-Buicks and 304 Overlands. In Alberta 5586 cars bear license plates; of this number there are 2695 Fords, 583 McLaughlin-Buicks and 312 Overlands.

To Enforce Boston Laws

BOSTON, MASS., April 15.—Police Commissioner O'Meara has sent word to the automobile people and garages that he has instructed the police to see that some of the motor laws that have not been enforced are lived up to from now on. One of the laws relates to allowing cars to stand on streets unattended for various periods, and without the motors shut off. The other law relates to smoking in garages.

Technically, Law Bars Non-Resident Motorists from Bay State

BOSTON, MASS., April 15.—According to W. A. Thibodeau, general counsel for the Automobile Legal Assn. of Boston, and an authority on motor laws, it is illegal for the residents of any other State, New Jersey excepted, to enter Massachusetts without registering despite the fact that there is a reciprocity law on the statute books. In fact it is because of the reciprocity law that non-

residents are legally not entitled to enter, and as a matter of fact, although Mr. Thibodeau does not say so outright, every non-resident who last year entered the State, except New Jersey motorists, did not do so legally. He calls attention to the fact that the blame for this is due to the Massachusetts Highway Commission. And also that it is not a serious matter, for no new legislation is needed, merely a meeting of the commission and a promulgation stating what States grant reciprocity and the length of time their motorists may stay in the Bay State.

Owners' Licensing Bill Passes Assembly

ALBANY, N. Y., April 19.—The Cromwell-Kelly bill, compelling owners who operate their cars in New York City to obtain licenses similar to a chauffeur's, passed the Assembly last night. It is expected that it will pass the Senate tomorrow. The license fee is \$1 for the first year and 25 cents for renewal.

Brown Bill Passes N. Y. Senate

ALBANY, N. Y., April 13.—Half of the automobile registration fees in New York State will go to the municipality in which they are paid, according to the Brown automobile registration bill which passed the Senate yesterday. This year New York State will spend \$16,000,000 for roads upstate, and 68 per cent of it will have to be paid by New York City. About \$10,000,000 is to be spent for new roads, \$4,000,000 for highway maintenance and \$2,000,000 for State aid.

To Lessen N. Y. Light Glare

ALBANY, N. Y., April 13.—The Hewitt resolution seeking a legislative investigation to provide means to lessen the glare of automobile lights was adopted to-day by the Senate. The desired appropriation of \$5,000 for expenses was cut to \$4,000.

Tibbitts 19 Years with Goodrich

AKRON, OHIO, April 17.—E. C. Tibbitts is celebrating the nineteenth anniversary of his appointment as advertising manager for the B. F. Goodrich Co. Tibbitts is the only advertising manager the Goodrich company has ever had.

Detroit Radiator to Sell Starter

DETROIT, MICH., April 14.—The Detroit Radiator and Specialty Co., this city has taken over the sales of the B-B mechanical starter, formerly handled by the Detroit Auto Accessory Co. The Detroit Radiator and Specialty Co., is also marketing the More Speed gears for Ford cars.

O'Donnell Wins Ascot Derby

His Duesenberg Averages 65.4 M.P.H. in 150-Mile Speedway Race

ASCOT SPEEDWAY, LOS ANGELES, CAL., April 15—*Special Telegram*—Eddie O'Donnell, in the Duesenberg won the 150-mile Ascot Motor Derby to-day, repeating his victory of Corona and ending his western racing engagements. His time was 2:17.09, or at an average speed of 65.4 m.p.h. Pullen, in a Mercer, was second in 2:17.27 4/5; Hughes, in the Omar, was third in 2:18.24 1/5; Waterman in a Gandy Special was running in fourth place when flagged; Tahis, in the Grant Special, was flagged when the crowd overran the course; Joe Thomas, in a Mercer, went out with a cracked cylinder in the fifth lap and Lou Gandy, in a Gandy Special, broke his oil line in the fiftieth lap. Lloyd, in an Oakland Special, stripped his timing gear at the start. R. C. Durant, who was to have driven the Cyclone, and Tetzlaff, who was to have driven the Durant Special, failed to appear.

Wheeler Resigns as Twin City Speedway President

INDIANAPOLIS, IND., April 13.—Frank H. Wheeler of Indianapolis has resigned as president of the Twin City Motor Speedway Assn. H. E. L. Habighorst of St. Paul, vice-president, will be temporary head. Meyers & Gates, attorneys of Indianapolis, have begun civil action against Mr. Wheeler in the Ramsey County District Court for \$24,334.50 attorneys' fees in connection with settlement of the Speedway's financial troubles last year. Mr. Wheeler said regarding the speedway that he is through with it.

Patterson Makes Fast Time

CHICAGO, ILL., April 10—E. C. Patterson, driving a Cadillac, made the best time yesterday in the trials at Speedway park for the non-professional drivers' race to be held May 20. Patterson averaged 74½ m.p.h. for ten laps, or 20 miles. Seven other entrants in the event were giving their cars workouts and making speeds in the neighborhood of 73 and 74 m.p.h. The cars out included Mercers, Cadillacs and Packards.

Sinsabaugh on Contest Board

NEW YORK CITY, April 15—C. G. Sinsabaugh, editor of *Motor*, has been appointed a member of the contest board of the American Automobile Assn. Another addition is A. G. Waddell, of California. Mr. Sinsabaugh served two terms as chairman of the contest com-

mittee of the Chicago Automobile Club.

The A. A. A. contest board consists of the following members: Richard Kenderdell, chairman; R. W. Smith, Colorado; C. I. Ryan, Georgia; David Beecroft, New York; F. A. Croselmir, New Jersey; F. G. Webb, New York; Clifford Ireland, Illinois; H. W. Knights, Massachusetts; P. D. Folwell, Pennsylvania; R. W. Carr, Texas; F. M. Fretwell, Washington; C. G. Sinsabaugh, New York, and A. G. Waddell, California.

Coatalen a Sheepshead Entry

NEW YORK CITY, April 19—The Sheepshead Bay Motor Speedway Corp. has received by cable the entry of Louis Coatalen in a Sunbeam for the opening races at Sheepshead Bay May 13.

A. E. Wood, who has been driving Stutz cars, on the Pacific Coast, is returning to the East for the Sheepshead opening and it is probable that he will appear at the wheel of one of Harry Harkness' Delage team.

Sheepshead Speedway Moves Offices

NEW YORK CITY, April 8—The Sheepshead Bay Motor Speedway Corp. to-day moved its offices from 17 Battery Place to the second floor of the Eley Bldg., Forty-ninth Street and Broadway.

The sale of tickets for the opening meet on May 13, will begin April 24, the McBride ticket agency handling the sale in New York City and Abraham & Straus in Brooklyn. Reservations of sections will be made for any automobile clubs which desire them.

Birmingham Speedway Started

BIRMINGHAM, ALA., April 14—The formal breaking of ground for the new speedway to be built in this city by the Birmingham Motor Speedway Co. will take place to-morrow.

Atwater Kent Ignition on Hupmobile

PHILADELPHIA, PA., April 15—The Atwater Kent Mfg. Works, this city, reports that the Hupp Motor Car Co., Detroit, Mich., has renewed its contract for Atwater Kent ignition on its 1917 cars.

Splitdorf Equipment for Lawson

NEWARK, N. J., April 17—The Splitdorf Electrical Co., this city, has contracted to supply the Lawson Mfg. Co. with Dixie 40 magnetos, spark plugs, high-tension switch and cables and electric lighting and starting outfits for the Lawson 1-ton truck.

Willys-Knight Adopts Adco

MILWAUKEE, WIS., April 15—The Willys-Knight 1916 series will use Adco coil spring shock absorbers, made by the Auto Device Mfg. Co., this city, as standard equipment.

Milwaukee Display a Success

Showroom Exhibition Sales Are Double Those Made at Indoor Show

MILWAUKEE, WIS., April 15.—A cumulative effort to stimulate retail car buying at the very opening of spring and the touring season best sums up any description of the second annual Dealers' Showroom Automobile Display conducted under the auspices of the Milwaukee Automobile Dealers, Inc., on April 11, 12 and 13. All Milwaukee and the territory for 50 miles around, served by interurban lines from Milwaukee, went motor shopping. While no actual figures of sales are available, dealers declare the display to have been a greater success than the first one, lasting but two days, in April, 1915. There were many visitors, of course, who were only sightseers, but compared with an indoor motor show, the showroom display sales record is better by two to one.

Prospects made at the Auditorium show of the M. A. D. in the middle of January were turned into purchasers at the three-day show this week. A better brand of weather could not have been served than that of the first day.

Each showroom was uniformly decorated, simply but elegantly, with Alabama smilax, palms, potted plants and cut flowers. The M. A. D. looked after the decorations. Some dealers augmented the scheme, and in the case of Harry Newman, Inc., Chalmers agent, a great deal of money was expended for auxiliary decorations on exterior and interior.

Chicago Used-Car Show Postponed

CHICAGO, ILL., April 15—The used car show, which was planned for this spring by the Chicago Automobile Trade Assn., has been postponed for probably one year. On account of the shortness of time after approval was given by the National Automobile Chamber of Commerce it was thought that it would be unwise to attempt to stage the show in May of this year.

100 Cars at Danville Show

DANVILLE, ILL., April 15—The first automobile show by the dealers of Danville and eastern Illinois, was held in the Chambers Building on April 12, 13 and 14. One hundred cars were on exhibition, together with a complete line of accessories.

Fifty Cars at Seattle Show

SEATTLE, WASH., April 14—With fifty representative cars on display, Seattle's third annual automobile show was held

in the Arena, and proved a stellar attraction for hundreds of automobilists and prospective car owners from the Pacific Northwest. Many of the visitors came from nearby Canadian cities and Portland, as well as from cities in the State.

The first automobile that ever traveled the streets of Seattle was ranged alongside one of the very latest models.

The steady increase in the price of lumber in the Northwest, coupled with the boom in shipping and other large business interests generally mean a big increase in business for the Seattle dealers, who will profit from the show.

Velie Buyers in Special Train

MOLINE, ILL., April 15—The Velie Co. chartered a special train from Iowa City, Iowa, Saturday, April 15, met 150 guests with a band at Davenport, Iowa, and escorted them via automobile to the Velie plant for a tour of inspection. A dinner was served for the guests at the Manufacturers' hotel in Moline and following the purchase of thirty new cars the owners drove back to Iowa City, taking with them the remainder of the party. In addition to the sale of the thirty cars the company shipped forty-two other cars on the same day.

Chevrolet Salesmen in Annual Meeting

NEW YORK CITY, April 14—The annual meeting of the Chevrolet Salesmen's Assn. was held at the factory of the Chevrolet Motor Co., West Fifty-seventh Street and Eleventh Avenue, this city, Friday April 7. The following officers were re-elected: Honorary president, W. C. Durant; honorary vice-president, W. C. Sills; president, W. A. Sellon; vice-president, H. Lauterbach; treasurer, M. C. Reeves; secretary, W. J. Owens.

Nation-Wide Tire Show This Week

NEW YORK CITY, April 17—During the week beginning to-day the concerns selling the United States Rubber Co.'s line of "balanced" tires will have special exhibitions and a corps of experts to explain exactly what "balanced" means and how the balance between fabric, carcass and rubber tread adds to the life of the tire.

Micatite Is New Pittsfield Plug

NEW YORK CITY, April 14—The name Micatite has been selected as the winner of the \$25 in gold offered by the Pittsfield Spark Coil Co., Pittsfield, Mass., for its new spark plug, which incorporates in its construction gas and air tight features. The name was suggested by F. L. Brown, 9400 Edmunds Avenue, Cleveland, Ohio. Over 5000 names were submitted.

Studebaker Tests Owners' Cars

To Teach Methods of Increasing Economy—Corrects Owners' Faults in Driving

DETROIT, MICH., April 17—In order to convince owners that they could operate their cars with greater gasoline economy if they would but handle them more intelligently, the Studebaker Corp. has recently carried on a number of tests in all sections of the country among owners of Studebaker cars. The idea has been worked out not with the thought of making tests primarily, but mainly to show owners how to get the greatest possible mileage per gallon.

In actual operation, the Studebaker plan has been carried out in somewhat the following manner: An expert calling upon an owner who is not getting maximum mileage, first disconnects the regular gasoline supply and attaches an auxiliary tank containing 1 gal. The owner then takes the wheel and drives a few miles, the expert at his side making mental notes the while. At the end of this run, the amount of gasoline used is measured.

The expert from the factory then believes the owner at the wheel. Before starting out he adjusts the carburetor, and any other things that may need adjusting, in order to obtain greatest economy in operation. The expert then drives the car and drives it properly, explaining the owner's faults to him as they go along.

Reports indicate that in most instances the owner did not have the carburetor adjusted to best advantage. In other cases he might have had a tendency to leave the motor running while away from the car for a considerable length of time. In still other instances his fault might be in speeding up the motor and slipping the clutch when a shift of gears would have been the logical thing to do. Possibly spark plugs might have influenced the economy. At any rate, the factory expert is doing some great missionary work, and the Studebaker Corp. likes the idea immensely.

Movies for Traffic Safety

DENVER, COL., April 14—A plan to promote traffic safety in Denver by means of motion pictures is being worked out by Commissioner of Safety Alexander Nisbet. He intends to prepare a special film showing how the most common accidents are caused, illustrating the purpose of the most important traffic rules, showing the right and wrong way for both vehicles and pedestrians to deal with the main features of traffic condi-

tions and requirements, and to furnish this film to all the moving picture theaters in the city. This method of spreading traffic knowledge is planned as an addition to a campaign of education now being conducted by the Department of Safety through printed rules and suggestions and through explanations given personally by traffic officers where occasion demands. There were 272 arrests of motorists during the month of March for violating traffic laws, and Commissioner Nisbet is seeking to remove causes for arrest by educating the public to work together for law observance and proper carefulness in general.

New York Eisemann Station in New Hands

NEW YORK CITY, April 13—The magneto service station in this city of the Eisemann Magneto Co. has been discontinued, the Auto Electric Service Co. taking over the stock, machines, etc. The latter company will continue at the same address, 245 West Fifty-fifth Street, and will act as service station for New York City proper, also Long Island City, Bronx, and Westchester and Rockland counties in New York State, and Bergen, Hudson, Essex and Union counties in New Jersey. The owners of the Auto Electric Service Co. are Henry Berlinghof, for the past three years service manager of the Eisemann Magneto Co., and George Strasser, for the past ten years foreman of the Eisemann repair department. W. B. Clowes succeeds Mr. Berlinghof as service manager at the company's plant in Brooklyn.

Johnson Detroit Gibney Manager

DETROIT, MICH., April 17—Following the resignation of Detroit branch manager H. L. Winter of the Gibney Tire & Rubber Co., O. S. Johnson has been appointed to manage the Gibney interests here. Mr. Johnson was formerly a district manager for the United States Tire Co.

Gramm-Bernstein in New York

NEW YORK CITY, April 14—The Gramm Worm-Drive Motor Truck Co. has leased 1204 sq. ft. of floorspace in the new Brokaw Building, in the Times Square district here, to act as eastern branch of the Gramm-Bernstein Co., Lima, Ohio.

Hess Is Firestone Cleveland Mgr.

CLEVELAND, OHIO, April 15—J. D. Hess, Jr., for three years a salesman in the Detroit branch of the Firestone Tire & Rubber Co., has been promoted to the management of the Cleveland office of the company.

Factory Miscellany

Canadian Regal to Build—The Canadian Regal Motors, Ltd., East Toronto, Ont., will build a factory costing approximately \$18,000.

Acme Rubber to Build—The Acme Rubber Co., Brampton, Ont., is contemplating building a plant at an estimated cost of \$30,000.

Houk to Build—The Houk Mfg. Co., Buffalo, N. Y., is completing plans for an addition at Elmwood Avenue and the New York Central Railroad.

Sparks-Withington to Build—The Sparks-Withington Co., Jackson, Mich., has completed plans for a new plant the same size as its present factory.

To Manufacture Tires—C. C. Coddington, Charlotte, N. C., and others, are interested in the establishment of a corporation capitalized at \$500,000 for the manufacture of automobile tires.

Buys Lexington Co. Plant—The Waller Mfg. Co., furniture manufacturer, Lexington, Ky., has purchased the former Lexington Automobile Co.'s plant.

Prudden's New Plant—The W. K. Prudden Co., Lansing, Mich., has awarded the contract for its new factory, 70 by 685

ft., three stories, to cost approximately \$100,000.

Hupp in Canada—The Hupp Motor Car Corp. has been granted permission to carry on a manufacturing business in Ontario with a capital stock of \$100,000.

Kleiber Truck's New Assembling Plant—The Kleiber Truck Co., San Francisco, Cal., has plans for a new motor truck assembling plant to be built at Fosom and Eleventh Streets, that city.

Kainer Adds—The Kainer Mfg. Co., Chicago, Ill., maker of automobile parts and pumps, has moved to 761 West Mather Street, where a brass foundry has been added to its facilities.

Dayton Body Co. Formed—The Dayton Body Co., Dayton, Ohio, has been formed with \$100,000 capital to manufacture automobile bodies. A factory will be constructed, 64 by 384 ft., four stories, of brick. J. D. Art is general manager.

Aluminum Goods to Double Size—The Aluminum Goods Mfg. Co., Manitowoc, Wis., has broken ground for a new shop addition, to be five stories high, 85 by 350 ft. in size, and contain the executive offices. It will require about five months'

time to complete the building. The capacity of the plant will thereby be doubled.

Kero Carbureter Formed—The Kero Carbureter Co. has been formed with a capital of \$15,000 by Milwaukee interests to manufacture fuel vaporizing devices for internal combustion engines. The incorporators are R. N. Van Doren, J. J. McJeskey and W. G. Gehrs.

Goodyear Issues Tire Repairing Manual—The Goodyear Tire & Rubber Co., Akron, Ohio, has issued the new Goodyear Manual of Tire Repairing. It is primarily a manual discussing the material, equipment and methods of application, necessary to the complete success of the tire repairman. The manual is illustrated.

Spoke and Wheel Factory Enlarges—The Bimel Spoke & Wheel Co., Portland, Ind., is extending its plant by the addition of six large kilns for the final seasoning of spokes and felloes. This will provide sufficient capacity for a daily production of 400 sets of pleasure car wheels and fifty to 100 sets of truck wheels.

The Automobile Calendar

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| April 24-29.....Bangor, Me., Show. | June 4.....Sheepshead Bay Speedway, 30-Mile Race, American Liberty Day Committee. | Aug. 5.....Tacoma Speedway Race, Tacoma Speedway Assn. |
| April 26-May 6.....Oakland, Cal., First Annual Pacific Coast Motor Power and Automobile Show, Automobile Industries Assn. | June 8.....New York City, Orphans' Day Outing at Donnelly's Grove, College Point, L. I. Orphan's Automobile Day Outing Assn. | Aug. 7-11.....Fremont, Neb., Tractor Demonstration. |
| April 29.....Fresno, Cal., Road Race, Raisin Classic Trophy Assn. | June 10.....Chicago Speedway Race, International 300-Mile Race, Speedway Park, Speedway Park Assn. | Aug. 11-12.....Pikes Peak, Col., Hill Climb, Pikes Peak Auto Highway Co. |
| May 6.....Sioux City, Iowa, Speedway Race, Sioux City Speedway Assn. | June 12-16.....S. A. E. Summer Trip on Great Lakes. | Aug. 12.....Portland, Ore., Track Race, Riegel-Hiller Co. |
| May 9-12.....Hot Springs, Va., N. A. A. A. J. Meeting, The Homestead. | June 16-17.....Sheepshead Bay Speedway, 24-Hr. Race, Trade Racing Assn., New York City. | Aug. 14-18.....Cedar Rapids, Ia., Tractor Demonstration. |
| May 13.....New York City, Sheepshead Bay Speedway Race, Metropolitan Trophy, 150 miles; Queens Cup, 50 miles; Coney Island Cup, 20 miles, and Brooklyn handicap for non-winners, 10 miles. | June 20.....Galesburg, Ill., Track Race, 100 miles. | Aug. 18-19.....Elgin Road Race, Chicago Auto Club. |
| May 14-20.....Milwaukee, Wis., Sheridan Road Week to Complete Highway Connecting Milwaukee and Chicago. | June 28.....Des Moines, Iowa, Speedway Free-for-all, 300-mile race. | Aug. 21-25.....Bloomington, Ill., Tractor Demonstration. |
| May 20.....Chicago Non-Professional Speedway Race, Western Interclub Speedway Park. | July.....LaGrande, Ore., Track Race, LaGrande Motor Club. | Aug. 28-Sept. 1.....Indiana Tractor Demonstration. |
| May 25.....Pennsylvania's Second Good Roads Day. | July 2-6.....Detroit, Mich., World's Salesmanship Congress, Detroit Board of Commerce Bldg. | Sept. 2-9.....Columbus, Ohio, Fall Show, Ohio State Fair, Columbus Automobile Show Co. |
| May 26-27.....Del Monte, Cal., Meeting, Three Divisions of National Assn. of Automobile Accessory Jobbers. | July 4.....Coeur d'Alene, Idaho, Race Meet, Hiller-Riegel Co. | Sept. 4.....Des Moines Speedway Invitation Race, Limited to six entries. |
| May 30.....Des Moines, Iowa, Iowa Derby, 20 Miles; Des Moines Special, 10 miles. | July 4.....Tacoma, Wash., Speedway Race, Tacoma Speedway Assn. | Sept. 4.....Indianapolis Speedway Race. |
| May 30.....Tacoma, Wash., 100-Mile Speedway Race, Tacoma Speedway Assn. | July 4.....Minneapolis 300-Mile Speedway Race. | Sept. 4-5.....Spokane, Wash., Track Race, Inland Auto Assn. |
| May 30.....Elmira, N. Y., Track Race, Elmira Auto & Motorcycle Racing Assn. | July 15.....Sioux City Speedway Race. | Sept. 4-8.....Madison, Wis., Tractor Demonstration. |
| May 30.....Indianapolis Speedway 300-Mile Race. | July 15.....Omaha, Neb., Speedway Race. | Sept. 11-16.....Milwaukee, Wis., Fall Show, Wisconsin State Fair, Milwaukee Automobile Dealers. |
| May 30.....Minneapolis, Minn., Speedway Race. | July 15.....North Yakima, Wash., Track Race, Riegel-Hiller Co. | Sept. 16.....Providence Speedway Race. |
| | July 17-21.....Dallas, Tex., Tractor Demonstration. | Sept. 29.....Trenton, N. J., Inter-State Fair, H. P. Murphy, Racing Sec. |
| | July 24-28.....Hutchinson, Kan., Tractor Demonstration. | Oct. 7.....New York City, Sheepshead Bay Speedway Race. |
| | July 31-Aug. 4.....St. Louis, Mo., Tractor Demonstration. | Oct. 7.....Philadelphia Speedway Race. |
| | | Oct. 7.....Omaha Speedway Race. |
| | | Oct. 14.....Chicago Speedway Race. |
| | | Oct. 19.....Indianapolis, Ind., Race, Indianapolis Motor Speedway. |
| | | Nov.....Santa Monica, Cal., Vanderbilt Cup and Grand Prix Races. |

The Week in the Industry



Jandorf Opens Accessory Shop—The Jandorf Automobile Co., New York City, has made another extension to its business by opening a new tire and accessory store at 1761 Broadway. In addition to the other Broadway quarter at 1759, this company occupies a building at 303 West Fifty-ninth Street with its body department. The factory and service shops are located at 239 West Fifty-sixth Street.

Pittsburgh Apperson in New Hands—The Apperson branch in Pittsburgh, Pa., has been sold to the E. A. Myers Co., 5977 Center Avenue. This company has at present under construction a new building at the corner of Louisa Street, Penant way and Girts way. It is 61 by 110 ft., five stories and fireproof. The company will move into it about June 1.

Philadelphia Packard Making Changes—Extensive changes are being made by the Packard Motor Car Co., Philadelphia, to its branches in the East. In Bethlehem a new showroom and service station, 55 by 100 ft., and one-story high, is being erected at Linden and Spruce Streets; a one-story building, 50 by 100 ft., is being erected at the corner of Mulberry and New Streets, Lancaster. Changes are also being made in Harrisburg, Wilmington and Reading. A showroom is building at Front and Market Streets, Harrisburg; a service station and showroom, 35 by 100 ft., at Ninth and Tatnall Streets, Wilmington, Del., and a service station in Reading for motor trucks exclusively.

N. Y. Timken Offices Moved—Beginning May 1, the New York offices of the Timken-Detroit Axle Co. and the Timken Roller Bearing Co. will be moved to room 713, United States Rubber Bldg. G. L. Bitting will remain in charge as eastern representative of the companies.

Takes Over B-B's Starter Sale—The Detroit Radiator & Specialty Co., Detroit, Mich., which handles the More Speed gears for Ford, has taken over the sales of the B-B starter, formerly handled by the Detroit Auto Specialty Co.

Twin City News—P. Knight, 1608 Crystal Lake Avenue, Minneapolis, will erect a one-story concrete block garage at 4101-3 Bryant Avenue S.

A. Barth, 537 Rice Street, St. Paul, has opened an automobile top and trimming shop, known as the St. Paul Auto Top Works.

L. M. Hick, St. Paul, will erect a story garage and storerooms at Sixth and Exchange Streets to cost \$17,000.

Trade Happenings

Macrae Heads Windsor Saxon—K. W. Macrae has been appointed manager of the Saxon branch in Windsor, Ont.

Spray Joins Timken—J. W. Spray is now connected with the sales force of the Timken Roller Bearing Co., Canton, Ohio. He was until recently sales representative in the Middle West of the Diamond Chain Co., Indianapolis, Ind.

Smith Leaves Winnipeg Maxwell—S. Smith of the Maxwell Motor Co., Winnipeg, Man., has severed his connection with that company to take a position with the head office of the company in Detroit.

Geary Joins McGraw Tire—F. S. Geary, formerly with the Kelly-Springfield Tire Co., New York City, has joined the McGraw Tire & Rubber Co., East Palestine, Ohio, as manager of its Newark branch, succeeding W. P. Fraley.

Sleight Heads Toronto Overland—F. J. Sleight, formerly manager of the Elyria factory of the Willys-Overland Co., has been appointed general manager of the Toronto, Ont., plant of that company.

Seaman Joins Knight Tire—L. I. Seaman, formerly associated with the Ajax Rubber Co., has joined the Knight Tire and Rubber Co. of N. Y., New York City, in the capacity of district representative in the western and northern portions of New York State.

Boston Trade Items—H. G. White, well known in oil circles, has joined the Pennsylvania Rubber Co., as New England traveling representative.

A. H. Allen, for the past seven years identified with the Packard factory at Detroit, is now assistant salesmanager for Alvan T. Fuller, the Packard dealer.

Homer Goodrich, who took on the Enger in Boston some months ago, has retired from the agency, and W. B. Fletcher is now president, with S. L. Bickford, treasurer, of the reorganized company.

Denver Men in New Roles—H. G. Peters, formerly treasurer of the Boss Rubber Co., Denver, is now president of the Peters-Tucker-Hay Rubber Co., 1513 Cheyenne Place.

E. A. Johnson, formerly traveling salesman for the United States Tire Co. and later with the Knight-Campbell Music Co., Denver, is now sales manager for the Hupp Motor Sales Co., 1260 Broadway, Colorado and Wyoming distributors for the Hupmobile and Locomobile.

E. M. Tucker, formerly store manager for the Quick Service Tire Co., Denver, is secretary-treasurer of the new Peters-Tucker-Hay Rubber Co., 1513 Cheyenne Place.

H. P. Federspiel, formerly with the Ford and Maxwell branches in Denver, is manager of the Colorado Motor Car Co., 1520 Broadway, Cole, Saxon and Reo distributor for Colorado and Wyoming.

R. E. Hay, formerly with the Boss Rubber Co., Denver, is vice-president of the Peters-Tucker-Hay Rubber Co., 1513 Cheyenne Place.

Washington Trade Items—The Auto Appliance Co. has opened in Tacoma with R. W. Cady, president, and associated with him are H. C. Lemagie and C. F. Powell. This firm handles the Federal and Goodyear tires and a well-selected line of accessories.

The H. L. Olive Co., Spokane, distributor of Overland machines, announces plans for the construction of a large addition to its home, which when completed will give it a floor space of 36,750 sq. ft.

C. C. Fagan has been appointed manager of the Pierce-Arrow service station in Portland, Ore.

The H. L. Mann Motor Co., Portland, Ore., has acquired the Oregon State agency of the Mercer, which he will handle in addition to the Haynes line.

Columbus News Items—The Broad-Oak Automobile Co., located at 622 Oak Street with a branch at 170 North Fourth Street, which has handled the Chalmers in central Ohio since that car has been on the market, has given up the agency and taken the Chandler in fourteen counties in central Ohio. The Chalmers agency in Columbus will be handled by a branch of the Fischer Auto & Service Co. of Cincinnati. The Columbus branch is located at 137 East Gay Street. A. G. Fischer will be the Columbus manager.

D. W. Short has been appointed Columbus representative of the Ohio-Metz-Elcar Co. of Cleveland, the Ohio representative of the Metz and Elcar. Columbus headquarters have been opened at 211 North Fourth Street.

The G-M Service & Specialty Co. has moved from its former location, 275 North Fourth Street, to 179 East Nightheten Street.

E. T. Paul, who has been doing a tire repair business at 123 Parsons Avenue, has added a full line of automobile accessories.

O. G. Roberts & Co., 933 East Gay

Street, which has handled the Overland in central Ohio territory for about eight years, has given up the agency to become effective some time previous to July 1.

California Items—A. W. Maxwell, formerly manager of the Studebaker Corp.'s interests in Arizona, has been appointed manager of the newly organized Studebaker commercial car branch in southern California, with headquarters at Los Angeles. The new Arizona manager is R. Robinson, formerly of Los Angeles.

Col. C. L. Hewes, formerly manager of the Oakland, Cal., Pacific Kissel Kar branch, has been appointed manager of the Kissel interests in Los Angeles. Colonel Hewes has been connected with the motor car industry in Oakland and San Francisco for many years and is well known throughout California. O. B. Henderson, former manager of the Los Angeles house and vice-president of the Pacific Kissel Kar branch, has retired from active work in the industry.

Mountain Retail—The Peters-Tucker-Hay Rubber Co., a new \$10,000 concern, has opened an agency for Knight and Blackstone tires at 1513 Cheyenne Place, Denver, and also a filling station in connection.

The Headington Auto Co., 1636 Broadway, Denver, Metz, Enger and H. A. Lozier distributor for Colorado and Wyoming, has been appointed official service station for the Master carburetor.

M. M. Rubner, Rawling, Wyo., Cadillac, Chalmers and Hupmobile dealer, has moved from Cedar Street, at the edge of town, to a more central location at 412 Lincoln Highway, where he has larger quarters for garage and salesroom.

The L. E. Kelton Motor Car Co., 1616 Broadway, Denver, Haynes distributor for Colorado and Wyoming, has secured the distributing agency for the Patterson for the same territory.

Mulnix & Rarie, 35 East Colfax Avenue, Denver, Grant and Pathfinder distributors for Colorado and Wyoming, have secured the agency for the Little Giant truck for the same territory.

The Maines-Hough Motor Co., 439 Broadway, Denver, Chevrolet, Monroe and Mitchell distributor for Colorado and Wyoming, has opened a branch salesroom in a more central location, at 17 East Colfax Avenue, with William R. Beattie in charge.

A. L. Davis, Arvada, Col., Chevrolet dealer, is putting up a \$15,000 building at Wadsworth Avenue and Grandview for salesroom, garage and extra offices. It will be 40 by 140 ft., of steel, concrete and brick construction, with two stories and a fireproof basement. The top floor will be rented for office use. The building will be finished the middle of April.

Wisconsin Trade Items—F. J. Chlupp, for ten years associated with the Burroughs Adding Machine Co., has taken

the position of manager of the Motor Car Sales Co., 136 Mason Street, Milwaukee, a large territory distributor of the Marmon and Oakland. The company is occupying temporary quarters and will soon move into its new garage and service station on Milwaukee Street, near Mason Street.

The Rice Lake Motor Car Co., Rice Lake, Wis., has taken occupancy of its new garage and repairshop, which, being 66 by 132 ft. in size, is one of the largest buildings devoted to garage purposes in any small city of Wisconsin.

The Olson-Paully Automobile Co., Manitowoc, Wis., has taken the Wisconsin State agency for the Ross 8 and will appoint agents in Milwaukee and other parts of the territory.

The Kern-Hughes Co., 955 Thirtieth Street, Milwaukee, has taken the State agency for Wisconsin of the Troy motor truck trailer. The Milwaukee Gas Light Co. has purchased a 5-ton trailer, one of the largest in use in Milwaukee.

The Hay Motor Sales Co., organized recently at Stevens Point, Wis., has been appointed district representative of the Elgin Motor Car Corp. A salesroom has been established in the Mansur Building on Strongs Avenue, and service station will be provided as soon as possible.

The J. J. Dougherty Co., 803 Grand Avenue, Milwaukee, accessories and supplies, has established a branch warehouse and salesroom at 398 Kenilworth Place, opposite the new branch plant of the Ford Motor Co. The concern specializes in material for Ford owners.

The Stutz Motor Co. of Milwaukee, headed by E. J. Weller, has been organized to handle the State agency for the Stutz in Wisconsin. Headquarters have been established at 115 Sycamore Street.

W. G. Schultz, for six years associated with the Reeke-Osmond Motor Car Co., Milwaukee, representing the Jeffery, has resigned to resume a connection as special traveling representative of the Thomas B. Jeffery Co., Kenosha, Wis. Mr. Schultz was with the Jeffery company before being transferred to the Milwaukee agency.

The Hilgendorf Hardware Co., 303 Third Street, Milwaukee, has taken the district agency for the Champion, the State agency for which is held by J. E. Murray, Wausau, Wis.

The Burd Piston Ring Sales Co., 424 Jefferson Street, Milwaukee, has moved its offices and warehouse to 813 Grand Avenue. The company represents the Burd product in Wisconsin and upper Michigan. P. C. Christman is general manager.

The Opsato Motor Plow Co., organized at Eau Claire, Wis., in the spring of 1915 to manufacture a gas plow and general utility farm tractor, has been reorganized as the Eau Claire Mfg. Co., and is now ready to begin a large pro-

duction. The company has completed its plant and installed the equipment. Officers have been elected as follows: President, R. B. Gillette; vice-president, J. P. Norrish; secretary and chief engineer, M. S. Opsato; treasurer, Charles Keller.

The Mechanical Appliance Co., 123-133 Stewart Street, Milwaukee, a large manufacturer of electric motors, generators and similar devices, is so rushed with orders that it has been found necessary to build a new shop, to be 30 by 130 ft. in size.

The Lemke Electric Co., 509-513 Cedar Street, Milwaukee, has been appointed official service and supply station for the Bijur Motor Lighting Co. The Lemke company is also official station for the Bosch, Simms and Mea magneto companies, Splitdorf Electrical Co., Rushmore Dynamo Works and Gray & Davis, Inc., and acts as official distributors for Wisconsin and northern Michigan.

The Ros-Wel Co., 112 Miller Building, Milwaukee, motor car specialties, is now marketing a new anti-freezing solution, trademarked "Uneeda." A large production is being undertaken in preparation for the coming cold weather season.

The big Arcadia Building, 615-625 Wells Street, Milwaukee, scene of some of the most important pugilistic bouts fought in this country in the last twelve years, is about to give way to the march of progress and will be rebuilt into a garage, which will be one of the largest in the Northwest in point of ground floor space. The big structure was originally known as the Hippodrome and was erected at a cost of \$100,000. Frank Mulhern, Milwaukee's millionaire newsboy and taxi operator, has held the building under lease for several years and is behind the project to transform it into a large downtown garage such as Milwaukee has long needed. In this building was held the first motor show in Milwaukee, the Milwaukee Automobile Club having promoted the first exhibition in March, 1908, before the now largest exposition building in Milwaukee, namely, the Auditorium, was completed.

The Badger Auto Body Co., Milwaukee, the incorporation of which was recently noted, is establishing a large shop at Lisbon Avenue and the Milwaukee road tracks, and will devote its efforts exclusively to the production of delivery bodies for automobiles, specializing in styles adapted to Ford chassis.

The Wadhams Oil Co., 215 National Avenue, Milwaukee, one of the largest distributors of oils, greases and motor fuels in the Middle West, will add another filling station to the list of stations in the city of Milwaukee. Plans have been prepared for a fireproof tank house, offices and drive at Ivanhoe Place and Prospect Avenue, one of the most prominent corners in the elite residence

district of the east side of Milwaukee.

The Hoppe-Hatter Motor Co., 539 Broadway, Milwaukee, agent for the Buick and State agent for the R. & L.-Baker electric and Owen magnetic, will move about June 15 to new and larger quarters now being erected for the firm on Milwaukee Street, just north of Oneida Street, in the heart of the east side motor district of Milwaukee. The building will be 50 by 120 ft. in size and contain a large service station. The present quarters of the Hoppe-Hatter company will be used by the Bartles-Maguire Oil Co., which has shared the big structure with the Buick agent for several years.

The Jefferson Automobile Co., Jefferson, Wis., district agent for the Ford, Buick and Oakland, is building an addition which will provide space for one of the largest and most completely equipped repairshops in any small city of Wisconsin.

Streator Co. Making Truck Bodies—The Alliance Manufacturing Co., Streator, Ill., which for many years was engaged in the construction of wagons and buggies, has gradually adjusted its business to changed conditions and is now devoting its attention largely to commercial truck bodies. As this business has reached a large scale, it has been decided to add hearses. The Alliance company will manufacture the bodies and the Barley company, also of Streator, will furnish the chassis. The "waste" or by-product of the Alliance company is being utilized in making wagon boxes for Montgomery & Ward of Chicago, the latter firm placing more orders than the Alliance plant can provide for.

Iowa Trade Items—J. F. Ochsner of Fort Madison, Iowa, has become agent for the Oakland.

The R. M. Tharp Auto Co., Waterloo, Iowa, is erecting a modern fireproof garage building and will take possession June 1. The firm handles the Jackson, Hupmobile and Allen cars.

The Hoover Auto Co., Oskaloosa, Iowa, has leased an adjacent building as an auxiliary garage. It will be used to store new cars.

J. S. Benson of Iowa City, Iowa, is to erect an automobile service station at Lynn and College Streets.

W. O. Campbell has purchased the Altmeyer Co. agency at Cedar Rapids. He will continue to handle the Studebaker.

H. F. Bierkamp and H. H. Horn have opened a garage at Milton, Iowa. A full line of accessories will be carried. William Broders has established a vulcanizing and tire repairing shop at Durant.

Jack Altmeyer of Cedar Rapids has been appointed general agent of the Dodge Bros. Co., for twelve counties. Headquarters will be in Waterloo.

The Iowa Motor Truck Co., Ottumwa, is working overtime manufacturing truck frames and assembling. The trucks are being manufactured at the plant of the American Mining Tool Co. The company reports many orders on the books.

W. W. Maish has resigned as assistant cashier of the Citizens National Bank, Des Moines, and has bought an interest in the States Auto & Supply Co., of which he will be secretary and treasurer.

Dubuque has been established as a distributing point for the Cadillac in Dubuque County and adjacent territory. W. L. Wallace will be resident manager and will establish a Cadillac service station.

Joseph A. Eisele of Davenport has bought out the Union Motor Co. of that city and has made a contract for the handling of the Chevrolet in this territory. He will also conduct a complete garage and repair establishment.

The Mercantile Warehouse Company of Waterloo has secured an admirable garage site on Commercial Street, near the Russell-Lamson Hotel, and plans the erection there of a new and up-to-date garage, 40 by 140 ft. One of the oldest residences in the city, built in 1850, will be torn down to make way for the new garage.

A new branch of the Studebaker Corp. is to be established immediately in Des Moines. It will supply parts to Studebaker owners and dealers in Iowa and adjacent territory in other States. The local branch will be in charge of J. A. Haskell, formerly assistant manager of the Studebaker branch at Cleveland, Ohio. A \$100,000 stock will be handled here, a force of fifteen men employed, and 5000 cars handled annually through this branch. A new building is to be erected to house the new branch. G. L. Willman, Studebaker sales manager, is here to help start the branch. He says Iowa should have twice as many cars.

Louisville Items—J. J. Pontius of Cincinnati has been appointed sales manager of the Oldsmobile Sales Co., 931 South Third Street, Louisville, Ky.

The Paige Motor Sales Co., 725 Third Street, agent for the Marion and Grant, has been appointed Haynes distributor in this territory.

The J. P. Hudson's Sons Co., 1046 East Main Street, well known to Louisville people and farmers of practically every county in Kentucky and southern Indiana as horse and mule dealers for the last twenty years, has acquired the agency for the Lippard-Stewart motor trucks, and would take in part payment for commercial vehicles horses, mules, wagons and harness. Being prepared to find a quick market for them, the Hudson firm then will sell the animals through its regular channels.

Adamson Vulcanizer to Add—The Adamson Mfg. Co., East Palestine, Ohio, is starting work on an addition to its plant to be 50 by 150 ft. and three stories high, total 22,500 sq. ft. of floor space. The new building will be of brick and glass construction, and will be used for increased production of Adamson vulcanizers and new patented devices. Work will be rushed so that the new plant can be occupied some time in June.

Piston Ring Co. Formed—The plant of the Piston Ring Co., Muskegon, Mich., will be doubled and the production, which is now at the rate of 27,000 piston ring castings a day, is to be increased to 50,000 or more a day. One addition to the plant will be a building 52 by 112 ft., while another addition will consist of a building, 119 by 112 ft. At least \$75,000 will be expended for additions.

Shakespeare Carburetor to Enlarge Plant—William Shakespeare, who manufactures the Shakespeare carburetor, will enlarge his factory in Kalamazoo, Mich., and is making provisions to enable a production of 20,000 carburetors, beginning next July.

Beechler Succeeds Goldie—R. G. Beechler, who was chief engineer of the metal products branch of the Timken-Detroit Axle Co., Detroit, Mich., has been appointed works manager, succeeding R. J. Goldie, who resigned.

Auto Body Takes Over Brewing Co.—The Lansing Brewing Co. has been taken over by the Auto Body Co., Lansing, Mich. Negotiations have been pending for some time, but it is said that the brewing company's stockholders did not wish to close up their business until indications were such that the State wide prohibition movement seems certain to make it very difficult for many breweries to keep on doing business in Michigan.

Warehouses for Automobiles—The Mason City Mfg. & Warehouse Co. has taken possession of the Colby plant at Mason City, Iowa, and expects soon to open an automobile warehouse for distribution purposes. The buildings are fireproof. An inclosed chute will lead to the railroad tracks. This will enable dealers in northwestern Iowa and southern Minnesota to buy their cars in larger numbers and will insure prompt deliveries to customers.

Spalding Lansing Foundry Mgr.—F. D. Spalding, Lansing, Mich., has been appointed manager of the Lansing Foundry Co. He was formerly assistant sales manager of the New-Way Motor Co.

Minor in Charge at Frisco—H. W. Minor has been put in charge of the San Francisco office of the American Bureau of Engineering and will push the sale of Ambu Electric Trouble Shooter in that territory. His address is 17 Powell Street.